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ABSTRACT

A curriculum outline is presented for a competency-based program in electronics with an option in the emerging field of alternative energies. It begins with a list of common tasks performed by electronics technicians. Course descriptions are provided for nine courses in an electronics technology curriculum. The list of related tasks is included for each course. The report of the task analysis survey follows; task survey instructions and task evaluation sheets are then presented. A preliminary course list for an alternative energy option to an electronics program contains descriptions of and prerequisites for eight courses. The tasks for each of these courses are then listed. Other contents include the employee and employer surveys and their results. An appendix contains the information package with material on the energy management program. (YLB)

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FINAL REPORT

1. Cover Page N/A
2. Frontispiece N/A
3. Foreword N/A
4. Body of Report

CURRICULUM OUTLINE FOR AN ELECTRONICS PROGRAM WITH AN ALTERNATIVE ENERGIES OPTION

Brittain A. Blair, Project Director
Southeastern Illinois College
Harrisburg, Illinois

September 12, 1984 - June 30, 1985

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FINAL REPORT ABSTRACT

TITLE: Curriculum Outline for an Electronics Program with Alternative Energies Option R-31-15-D-0332-5

PRINCIPAL INVESTIGATOR: Brittain A. Blair; Sam Porter, Chairman Math and Science Division

INSTITUTION: Southeastern Illinois College

LOCATION: R.R. #4, College Drive, Harrisburg, Illinois 62946

OBJECTIVES:

1. Identify by January 31, 1985 the tasks that electronics technicians with an alternative energies option must perform to be considered competent in the field.

2. Analyze by January 31, 1985 the tasks that electronics technicians with an alternative energies option must perform to be considered competent in the field.

3. Develop by June 30, 1985 competency-based units of instruction that will provide students with the performance skills necessary to be competent in the field of electronics and alternative energies.

4. Conduct by June 30, 1985 a labor market study to determine the current and projected need for electronics technicians and electronics technicians with a specialization in alternative energies.

PROCEDURES:

1. Prior to September 30, 1984 project personnel will establish an advisory council to assist in identifying and analyzing tasks. (Objectives 1 & 2)

2. Prior to September 30, 1984 project staff will review current V-TECS materials to identify and analyze tasks. (Objectives 1 & 2)

3. Prior to October 31, 1984 project personnel will survey advisory council members to identify and analyze tasks. (Objectives 1 & 2)

4. Prior to October 31, 1984 project personnel will identify exemplary programs in electronics and alternative energies. (Objectives 1 & 2)

5. Prior to November 15, 1984 project personnel will select a number of exemplary programs in electronics and alternative energies for on-site visits. (Objectives 1 & 2)

6. Prior to December 31, 1984 project personnel will review, during on-site visits, the curricula of a select number of exemplary programs in electronics and alternative energies. (Objectives 1 & 2)

7. Prior to January 31, 1985 project personnel will identify a final list of tasks. (Objective 1)

8. Prior to February 28, 1985 project personnel will designate, according to task classification, the courses that will make up an electronics technology curriculum with an alternative energies option. (Objective 3)

9. Prior to June 30, 1985 project personnel will develop competency-based units of instruction for an electronics technology curriculum with an alternative energies option. (Objective 3)

10. Prior to June 30, 1985 project personnel will conduct a labor market study to determine the current and projected need for electronics technicians and electronics technicians with a specialization in alternative energies. (Objective 4)

11. Prior to June 30, 1985 project personnel will administer a survey to business and industry to further determine the current and projected need for electronics technicians and electronics technicians with a specialization in alternative energies. (Objective 4)

EXPECTED CONTRIBUTION OR POTENTIAL IMPACT ON VOCATIONAL AND TECHNICAL EDUCATION

The competency-based units of instruction will benefit vocational education by providing the first step in developing a unique program in electronics that will allow vocational-technical students to become competent in the emerging field of alternative energies.

PRODUCTS TO BE DELIVERED

Task list and analysis to be mailed to DAVTE by January 31, 1985.

Units of Instruction will be mailed to DAVTE by June 30, 1985.

Labor Market Study will be mailed to DAVTE by June 30, 1985.

Final Report will be mailed to DAVTE by June 30, 1985.

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Illinois State Board of Education

Department of Adult, Vocational and Technical Education
Research and Development Section

Product Abstract

1. Title of material: Final Report: Curriculum Outline for an Electronics Program with an Alternative Energies Option

2. Date material was completed: July 31, 1985

3. Please check one: New material [x] Revised material [ ]

4. Originating agency: Southeastern Illinois College
   Address: RR #4, College Drive Harrisburg, Illinois Zip Code: 62946

5. Name(s) of developer(s): Brittain A. Blair, Sam Porter, Jeff Graef
   Address: Southeastern Illinois College, Harrisburg, Illinois Zip Code: 62946

6. Developed pursuant to Contract Number: R-31-15-D-0332-533

7. Subject Matter (Check only one according to USOE Code):

   USOE Code

   - [ ] 01 Agricultural Education
   - [ ] 03 Business and Office Education
   - [ ] 04 Distributive Education
   - [ ] 07 Health Occupations Education
   - [ ] 09 Home Economics Education
   - [ ] 10 Industrial Art Education
   - [x] 16 Technical Education
   - [ ] 17 Trade and Industrial Education
   - [ ] 22 Cooperative Education
   - [ ] Career Education
   - [ ] Other (Specify) _____

8. Education Level:

   - [ ] Pre-K Thru 6
   - [ ] 7-8
   - [ ] 9-10
   - [ ] 11-12
   - [x] Post-Secondary
   - [ ] Adult
   - [ ] Teacher (Pre-service)
   - [ ] Administrator (Pre-Service)
   - [ ] Other (Specify) _____

9. Intended for Use By:

   - [ ] Student
   - [x] Classroom Teacher
   - [x] Local Administrator
   - [x] Teacher Educator
   - [ ] Guidance Staff
   - [ ] State Personnel
   - [ ] Other (Specify) _____

10. Student Type

    - [x] Regular
    - [ ] Disadvantaged
    - [ ] Handicapped
    - [ ] Limited English Proficiency
    - [ ] Other (Specify) _____

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16. General Description (State the general objective and suggested method of use. Summarize the content and tell how it is organized. Continue on back of this sheet or on another sheet, if necessary.): The Final Report contains a list of validated tasks that will benefit vocational education by providing the first step in developing a unique competency-based curriculum in electronics with an alternative energies option.

17. Person Completing this Abstract: Brittain A. Blair, Project Director

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RESOURCE LISTING

1. Energy Audits Center for Occupational Research & Development

2. Energy Conservation Center for Occupational Research & Development

3. Energy Economics Center for Occupational Research & Development

4. Fundamentals of Energy Technology Center for Occupational Research & Development

5. Solar Energy V-TECS

ACCOMPLISHMENTS

1. Compiled a validated task list as the first step in developing a unique competency-based curriculum in electronics with an alternative energies option.

2. Conducted a survey of business and industry to assess the need for electronics technicians with training in alternative energies technologies.

STATEMENT OF IMPACT

The validated tasks will benefit vocational education by providing the first step in developing a unique program in electronics that will allow vocational-technical students to become competent in the new and emerging field of alternative energies.

A CURRICULUM OUTLINE FOR AN ELECTRONICS PROGRAM WITH AN ALTERNATIVE ENERGIES OPTION

A FINAL REPORT
COMPILED FOR THE
ILLINOIS STATE BOARD OF EDUCATION
DEPARTMENT OF ADULT, VOCATIONAL AND TECHNICAL EDUCATION

Britain A. Blair, Project Director
Sam Porter, Instructor
Jeff Graef, Consultant

Southeastern Illinois College
Harrisburg, Illinois

July 30, 1985

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VIII. Employer Survey

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I. TASK LIST - ELECTRONICS

Because of the lack of electronic industries in the Southeastern Illinois College district, the list of compentencies turned in by our electronics advisory council was extended to include a list compiled by Dr. Charles Francis Solomon at Texas State Technical Institute. Dr. Solomon surveyed 429 electronic industries across the state of Texas. He surveyed electronic technicians and their immediate supervisor. One hundred and eighteen technicians and 122 supervisors returned usable surveys. We have grouped these tasks or competencies under the course listings now existing in Southeastern Illinois College's electronics curriculum.

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   Marissa Shop
   Marissa, IL 62257

Common Tasks Performed by Electronics Technicians

Number	Description
A 001	Use a Volt-ohm-milliammeter (VOM)
A 002	Use a Digital Voltmeter (DVM)
A 003	Use a Transistor Voltmeter
A 004	Use a Laboratory Type Oscilloscope
A 005	Use a Storage Oscilloscope
A 007	Use a Impedance Bridge
A 008	Use a Thermocouple Meter
A 009	Use a Wattmeter
A 010	Use a Tube Tester
A 011	Use a Transistor Checker
A 013	Use a Spectrum Analyzer
A 014	Use a Total Harmonic Distortion Analyzer
A 016	Use a Audio Frequency Signal Generator
A 017	Use a Radio Frequency Signal Generator
A 018	Use a Function Generator
A 020	Use a X-Y Plotter
A 021	Use a Capacitor Tester
A 023	Use a Frequency Counter
A 025	Use a Regulated Power Supply with Voltage and Current Control
A 026	Use a Pulse Generator
A 033	Use a Sweep Generator
A 034	Use a Logic State Analyzer
A 035	Use Logic Development Systems
A 036	Use a Signature Analyzer
A 037	Use Emulators
A 038	Use Transistor Parameters
A 039	Use Equivalent Circuits
A 040	Use Characteristic Curves
A 041	Use Transistor Biasing Techniques
A 046	Use Load Lines AC/DC
A 047	Use Operational Amplifier
A 048	Use Operational Amplifier in Different Configurations
A 049	Determine Operational Amplifier Gain
A 050	Determine Semiconductor Amplifier Gain
A 051	Write Computer Programs in Machine Language
A 052	Write Computer Programs in Basic
B 055	Select Capacitors according to their Characteristics, e.g., Mica, Electrolytic, Tantalum, Polycarbonate
B 056	Measure Thermal Properties of Semiconductors
B 058	Determine Transistor Noise, Amplifier Noise, or Oscillator Noise
B 059	Measure Decibels

Number	Description
B 060	Measure DC Amplifier Gain
B 061	Measure AC Amplifier Gain
B 062	Measure Frequency Response
B 063	Measure Current, Voltage, and Power Gain
B 064	Measure Emitter Collector Phase Relationship
C 065	Measure Input or Output Impedances
C 066	Trouble Shoot, RC Time Constant Circuits
C 067	Trouble Shoot, Resonant Filter Circuits
C 068	Trouble Shoot, Voltage Dividers and/or Doublers
C 082	Trouble Shoot, PN Junction Diode Circuits
C 083	Trouble Shoot, Point Contact Type Diode Circuits
C 084	Trouble Shoot, Zeners Diode Circuits
C 085	Trouble Shoot, Tunnel Diode Circuits
C 086	Trouble Shoot, Photo Diode Circuits
C 087	Trouble Shoot, Silicon Controlled Rectifier Circuits
C 088	Trouble Shoot, Variable Capacitance Diode Circuits
C 089	Trouble Shoot, Hall Effect Device Circuits
C 090	Trouble Shoot, Junction Type Transistor Circuits
C 092	Trouble Shoot, Photo Transistor Circuits
C 093	Trouble Shoot, Power Transistor Circuits
C 094	Trouble Shoot, Unijunction Transistor Circuits
C 095	Trouble Shoot, Thyristor Circuits
C 096	Trouble Shoot, Field Effect Transistor Circuits
C 097	Trouble Shoot, Half or Full Wave Rectifier Circuits
C 098	Trouble Shoot, Active Filter Circuits
C 099	Trouble Shoot, Polyphase Power Supply Circuits
C 101	Trouble Shoot, Power Supply Circuits
C 102	Trouble Shoot, Magnetic Amplifier Circuits
C 104	Trouble Shoot, Attenuator Circuits
C 105	Trouble Shoot, Time Delayed-Action Circuits
C 106	Trouble Shoot, RC Phase Shift Oscillators
C 117	Trouble Shoot, Voltage Controlled Oscillator
C 118	Trouble Shoot, 555 Timer Circuits
C 142	Trouble Shoot, Common Emitter, Common Collector, or Common Base Configuration Type Circuits
C 143	Trouble Shoot, Push-Pull Amplifier Circuits
C 146	Trouble Shoot, RC Coupled Audio Amplifier Circuits
C 147	Trouble Shoot, Transformer Coupled Audio Amplifier Circuits
C 148	Trouble Shoot, Direct Coupled Amplifiers
C 150	Trouble Shoot, Bridged Power Amplifier Circuits

Number	Description
C 151	Trouble Shoot, IC Type Power Amplifier Circuits
C 152	Trouble Shoot, Tuned Amplifier Circuits
C 155	Trouble Shoot, Phase Inverters
C 156	Trouble Shoot, Modulation, Mixing, or Detection Circuits
C 157	Trouble Shoot, AGC Circuits
C 158	Trouble Shoot, Transients and Glitches
C 159	Trouble Shoot, Waveform Generator Circuits
C 160	Trouble Shoot, Diode and Triode Switching Circuits
C 161	Trouble Shoot, Free Running Multivibrator Circuits
C 162	Trouble Shoot, Bistable Multivibrator Circuits
C 163	Trouble Shoot, Astable Multivibrator Circuits
C 164	Trouble Shoot, Monostable Multivibrator Circuits
C 168	Trouble Shoot, Gating Circuits
C 169	Trouble Shoot, Delay Circuits
C 171	Trouble Shoot, Pulse Generator Circuits
C 172	Trouble Shoot, Triggering Circuits
C 173	Trouble Shoot, Pulse Counter Circuits
C 174	Trouble Shoot, Logic Circuits
C 175	Trouble Shoot, Pulse Amplifier Circuits
C 176	Trouble Shoot, Linear Wave Shaping Circuits
C 177	Trouble Shoot, Null Detector Circuits
C 178	Trouble Shoot, Limiting Circuits
C 179	Trouble Shoot, Clamping Circuits
C 180	Trouble Shoot, Counter (Frequency Dividers) Circuits
C 181	Trouble Shoot, Diode Clipper Circuits
C 182	Trouble Shoot, Sawtooth Wave Form Circuits
C 185	Trouble Shoot, Transistor Sweep Generator Circuits
C 187	Trouble Shoot, SCR and Triac Switching Circuits
C 247	Trouble Shoot, AC and DC Generators
C 248	Trouble Shoot, AC and DC Motors
C 249	Trouble Shoot, Single Phase Circuits
C 250	Trouble Shoot, Three Phase Circuits
C 251	Trouble Shoot, Converters, Inverters, and Dynamotor
C 252	Trouble Shoot, Motor Speed Regulators
C 253	Trouble Shoot, Automatic Motor Controls
C 259	Trouble Shoot, Common Servomechanism Systems
C 261	Trouble Shoot, Control Transformers
C 263	Trouble Shoot, Electronic Motor Control System
C 266	Trouble Shoot, Transducers

Number	Description
C 267	Trouble Shoot, Thermistors
C 269	Trouble Shoot, Varistors
C 270	Trouble Shoot, Time-Delay Relays
C 271	Trouble Shoot, High Current Polyphase Rectifiers
C 272	Trouble Shoot, High-Speed Light and Register Controls
C 274	Trouble Shoot, Electronic Timer Circuits
C 276	Trouble Shoot, Photoelectric Devices
C 277	Trouble Shoot, SCR and Triac Motor Control Circuits
C 279	Do Chassis Building
C 280	Do Chassis Layout
C 281	Do Tapping or Threading
C 284	Do Soldering
C 285	Lay out Printed Circuit Boards
C 286	Make Printed Circuit Boards
C 287	Use Verbal Communications
C 288	Use Written Communications
C 289	Write Technical Reports
C 290	Trouble Shoot, Current Limited Supplies
C 291	Trouble Shoot, Remote Sensing
C 292	Trouble Shoot, Automatic Crossover
C 293	Trouble Shoot, Transistor Voltage Regulators
C 294	Trouble Shoot, Transistor Current Regulators
C 295	Trouble Shoot, Inverters or Switching Power Supplies, e.g., Stepdown, Feedforward, Stepup, Flyback
C 296	Trouble Shoot, Clock Chips
C 297	Trouble Shoot, Microprocessor Chips (8 Bit)
C 298	Trouble Shoot, Microprocessor Chips (16 Bit)
C 299	Trouble Shoot, Semiconductor Memories
C 302	Trouble Shoot, Programmable Timers
C 303	Trouble Shoot, Programmable Interrupt Controllers (PIC)
C 306	Trouble Shoot, PROMS
C 307	Trouble Shoot, Device Controllers, e.g., Disk, Keyboard, Display (CRT) Printers
C 308	Trouble Shoot, EPROM
C 312	Trouble Shoot, I/O Addressing
C 313	Trouble Shoot, Interrupts
C 314	Trouble Shoot, Timing Loops
C 321	Trouble Shoot, Digital to Analog Converters
C 322	Trouble Shoot, Analog to Digital Converters
C 323	Trouble Shoot, Sample and Hold Circuits
C 324	Trouble Shoot, Analog or Digital Multiplexers

Number	Description
C 330	Trouble Shoot, LED Displays, e.g., Seven Segment, Multiplexing LED's, Matrix LED, and LCD's
C 331	Trouble Shoot, Teletype, e.g., RS 232 and I/O Subroutines
C 340	Trouble Shoot, Buss Systems, e.g., S-100, IEEE-488, IEEE-583 CAMAC, EIA-RS232C, EIA-RS422
C 341	Trouble Shoot, Interface Chip Circuits, e.g., UART, PIO, DMAC, PIC, PIT, PIA, CTC
C 343	Trouble Shoot, TTL Type IC's
C 344	Trouble Shoot, CMOS Type IC'S
C 345	Trouble Shoot, ECL Type IC's
C 347	Trouble Shoot, Linear IC'S (OP-AMPS)
C 349	Trouble Shoot, Circuits which use Photoconductive Cells
C 351	Trouble Shoot, Photo Diodes
C 352	Trouble Shoot, Photo Transistors
C 354	Trouble Shoot, Light Activated SCR'S
C 356	Trouble Shoot, Optocouplers
C 364	Perform Attenuation Measurements
C 365	Perform Power Measurements
C 367	Perform Frequency Measurements
C 368	Perform Phase-Shift Measurements
C 370	Perform Noise Measurements

Means and Standard Deviations for each Section

No.	Titles	Technicians Mean	Technicians S.D.	Supervisors Mean	Supervisors S.D.
1.	Using Test Equipment	33.0	30.2	43.9	32.3
2.	Using Semiconductor Parameters	32.5	23.8	39.5	29.0
3.	Computer Programming	22.5	15.3	28.3	21.6
4.	Measure	43.3	17.8	49.2	19.3
5.	Passive Circuits	65.7	23.1	75.0	22.3
6.	Vacuum Tube Circuits	12.5	9.1	21.2	11.1
7.	Semiconductor Circuits	53.0	29.9	65.0	31.2
8.	Oscillator Circuits	16.1	16.9	29.2	19.1
9.	Radio Frequency Circuits	12.0	5.6	20.3	7.3
10.	Audio Circuits	25.2	12.5	37.7	12.7
11.	Communications Circuits	18.3	7.6	25.3	10.0
12.	Pulse and Switching Circuits	38.5	20.6	48.9	20.3
13.	Television Circuits	10.0	6.5	14.5	7.1
14.	Microwave Circuits	3.0	2.8	5.9	3.7
15.	Motor Control Circuits	23.7	17.1	28.4	18.1
16.	Mechanical	32.8	31.5	46.8	28.8
17.	English (Communication Skills)	69.0	18.7	87.3	15.0
18.	Power Supplies	52.2	25.0	67.7	28.7
19.	Digital Circuits	30.2	21.9	41.1	23.9
20.	Optical Electronic Devices	20.6	14.4	29.5	16.7
21.	Measurement Tasks Performed	20.9	15.9	23.6	17.3
Overall Inventory Task Sum		26.2	24.2	34.6	26.9

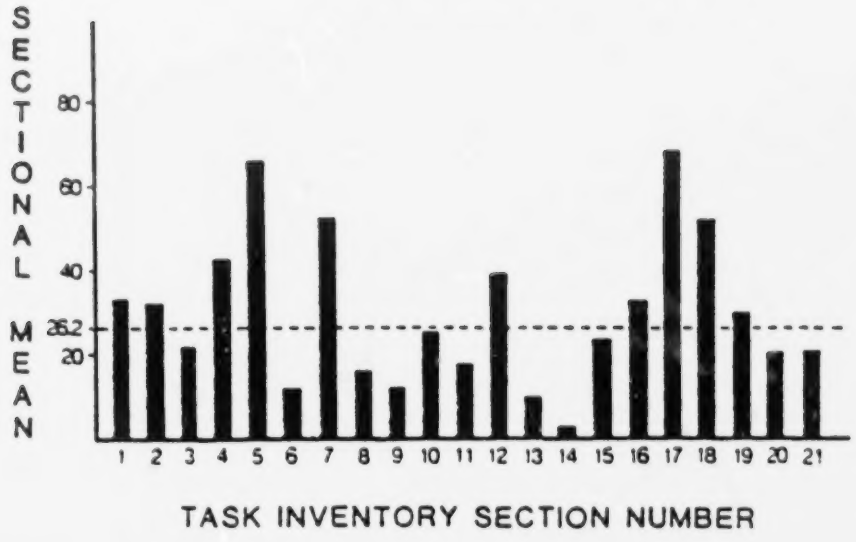

FIGURE Sectional Task Sum Mean for the Task Inventory Sections for the Technicians

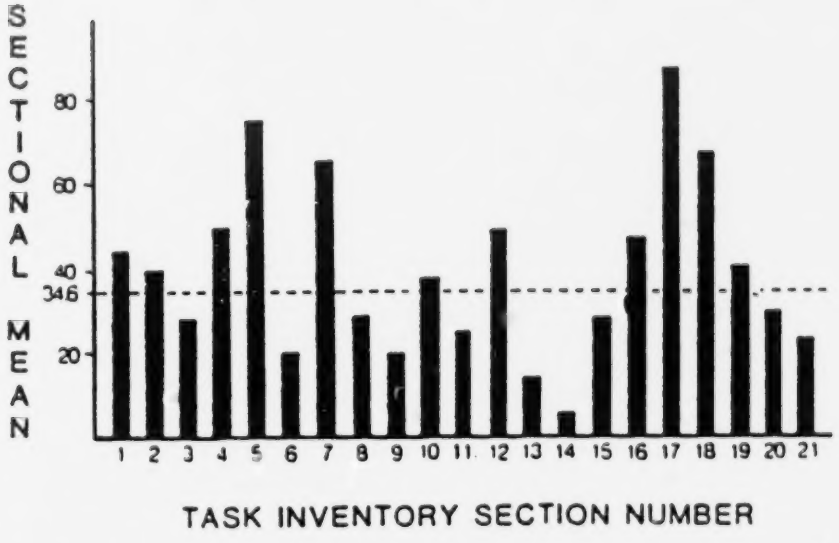

FIGURE Sectional Task Sum Mean for the Task Inventory Sections for the Supervisors

ELT 112 - 5 hours -Electricity Concepts

A study of the relationship between current, voltage, resistance and power for direct current and alternating current circuits. Subjects included are: Analysis of series and parallel circuits, study of network theorems and Kirchhoff Laws, theory and use of multi-meters, electronic voltage meters and Watt meters, study of inductors, capacitators, reactance and impedance. The laboratory is closely coordinated with the class work to verify circuit theory. Lab work includes instruction on safety rules and standard practices, use of hand tools and machine tools and use of slide rule and tables in electrical calculations.

Use a Volt-ohm-milliammeter (VOM)

Use a Laboratory Type Oscilloscope

Use a Thermocouple Meter

Use a Wattmeter

Use an Audio Frequency Signal Generator

Use a Function Generator

Use a Capacitor Tester

Use a Regulated Power Supply with Voltage

Select Capacitors according to their Characteristics, e.g., Mica, Electrolytic, Tantalum, Polycarbonate

Trouble Shoot

Trouble Shoot, Voltage Dividers and/or Doublers

Trouble Shoot, Zeners Diode Circuits

Trouble Shoot, Silicon Controlled Rectifier Circuits

Trouble Shoot, Half or Full Wave Rectifier Circuits

Trouble Shoot, Polyphase Power Supply Circuits

Trouble Shoot, Power Supply Circuits

Trouble Shoot, 555 Timer Circuits

Trouble Shoot, Thermistors

Trouble Shoot, Varistors

Lay out Printed Circuit Boards

Make Printed Circuit Boards

Trouble Shoot, LED Displays, e.g., Seven Segment, Multiplexing LED's, Matrix LED, and LCD's

Perform Power Measurements

Perform Frequency Measurements

Perform Phase-Shift Measurements

ELT 113 - 5 hours - AC-DC Circuit Analysis

Subjects studied are impedance networks, theorems, resonance, transformers, coupled circuits, three phase systems, attenuators and filters. Wire sizes, wiring practices and national electrical code are also covered.

Use a Radio Frequency Signal Generator

Measure Frequency Response

Trouble Shoot, RC Time Constant Circuits

Trouble Shoot, Resonant Filter Circuits

Trouble Shoot, Active Filter Circuits

Trouble Shoot, Attenuator Circuits

Trouble Shoot, Common Emitter, Common Collector, or Common Base Configuration Type Circuits

Trouble Shoot, Linear Wave Shaping Circuits

Lay out Printed Circuit Boards

Make Printed Circuit Boards

Trouble Shoot, Linear IC'S (OP-AMPS)

ELT 114 - 4 hours - Power Distribution

A study of the sources and distribution of electrical power generators, transmission lines, transformers and distribution of power for residential, commercial and industrial will be stressed.

Use a Digital Voltmeter (DVM)

Use a Wattmeter

Trouble Shoot, Polyphase Power Supply Circuits

Trouble Shoot, Single Phase Circuits

Trouble Shoot, Three Phase Circuits

Trouble Shoot, Converters, Inverters, and Dynamotor

ELT 115 - 4 hours - Digital Electronics I

Analysis of wave shaping circuits, clipping and clamping circuits, multivibrators, negative resistance devices and blocking isolators. Also includes number systems, codes, Boolean Algebra, logic circuits and logic circuit designs. The laboratory experiments emphasize the investigation and design of basic circuits.

Use a Frequency Counter

Use a Logic State Analyzer

Use Operational Amplifier

Measure DC Amplifier Gain

Measure Emitter Collector Phase Relationship

Trouble Shoot, Common Emitter, Common Collector, or Common Base Configuration Type Circuits

Trouble Shoot, IC Type Power Amplifier Circuits

Trouble Shoot, Transients and Glitches

Trouble Shoot, Waveform Generator Circuits

Trouble Shoot, Diode and Triode Switching Circuits

Trouble Shoot, Free Running Multivibrator Circuits

Trouble Shoot, Bistable Multivibrator Circuits

Trouble Shoot, Astable Multivibrator Circuits

Trouble Shoot, Monostable Multivibrator Circuits

Trouble Shoot, Gating Circuits

Trouble Shoot, Pulse Counter Circuits

Trouble Shoot, Logic Circuits

Trouble Shoot, Pulse Amplifier Circuits

Trouble Shoot, Limiting Circuits

Trouble Shoot, Clamping Circuits

Trouble Shoot, Counter (Frequency Dividers) Circuits

Trouble Shoot, Diode Clipper Circuits

Trouble Shoot, Sawtooth Wave Form Circuits

Trouble Shoot, AC and DC Motors

Trouble Shoot, High-Speed Light and Register Controls

Trouble Shoot, Electronic Timer Circuits

Trouble Shoot, Inverters or Switching Power Supplies, e.g., Stepdown, Feedforward, Stepup, Flyback

Trouble Shoot, Clock Chips

ELT 115 - 4 hours - Digital Electronics I (continued)

Trouble Shoot, Semiconductor Memories

Trouble Shoot, Programmable Timers

Trouble Shoot, PROMS

Trouble Shoot, I/O Addressing

Trouble Shoot, Timing Loops

Trouble Shoot, Analog or Digital Multiplexers

Trouble Shoot, LED Displays, e.g., Seven Segment, Multiplexing LED's, Matrix LED, and LCD's

Trouble Shoot, TTL Type IC's

Trouble Shoot, CMOS Type IC's

Lay out Printed Circuit Boards

Make Printed Circuit Boards

ELT 116 - 4 hours - Digital Electronics II

An intensive study of digital systems including arithmetic circuits, permanent storage devices, registers, imput-output, control digital to analog, and analog to digital conversion.

Use a Logic State Analyzer

Use Emulators

Write Computer Programs in Machine Language

Write Computer Programs in Basic

Trouble Shoot, Common Emitter, Common Collector, or Common Base Configuration Type Circuits

Trouble Shoot, IC Type Power Amplifier Circuits

Trouble Shoot, Transients and Glitches

Trouble Shoot, Logic Circuits

Trouble Shoot, Electronic Timer Circuits

Lay out Printed Circuit Boards

Make Printed Circuit Boards

Use Written Communications

Write Technical Reports

Trouble Shoot, Inverters or Switching Power Supplies, e.g., Stepdown, Feedforward, Stepup, Flyback

Trouble Shoot, Clock Chips

Trouble Shoot, Microprocessor Chips (8 Bit)

Trouble Shoot, Semiconductor Memories

Trouble Shoot, PROMS

Trouble Shoot, Device Controllers, e.g., Disk, Keyboard, Display (CRT) Printers

Trouble Shoot, EPROM

Trouble Shoot, I/O Addressing

Trouble Shoot, Interrupts

Trouble Shoot, Timing Loops

Trouble Shoot, Digital to Analog Converters

Trouble Shoot, Analog to Digital Converters

Trouble Shoot, Sample and Hold Circuits

Trouble Shoot, Analog or Digital Multiplexers

Trouble Shoot, Teletype, e.g., RS 232 and I/O Subroutines

Trouble Shoot, Buss Systems, e.g., S-100, IEEE-488, IEEE-583 CAMAC, EIA-RS232C, EIA-RS422

Trouble Shoot, Interface Chip Circuits, e.g., UART, PIO, DMAC, PIC, PIT, PIA, CTC

Trouble Shoot, Electronic Motor Control System

ELT 117 - 4 hours - Industrial Circuits and Controls

The advance study of DC and AC rotating machines and controls. Industrial electronic controls are also covered along with industrial wiring practices and motor repair. The study of servomechanisms as used in industry is also covered.

Use a Logic State Analyzer

Trouble Shoot, PN Junction Diode Circuits

Trouble Shoot, Point Contact Type Diode Circuits

Trouble Shoot, Photo Diode Circuits

Trouble Shoot, Hall Effect Device Circuits

Trouble Shoot, Photo Transistor Circuits

Trouble Shoot, Unijunction Transistor Circuits

Trouble Shoot, Thyristor Circuits

Trouble Shoot, Polyphase Power Supply Circuits

Trouble Shoot, Magnetic Amplifier Circuits

Trouble Shoot, Time Delayed-Action Circuits

Trouble Shoot, Common Emitter, Common Collector, or Common Base Configuration Type Circuits

Trouble Shoot, Gating Circuits

Trouble Shoot, Delay Circuits

Trouble Shoot, Limiting Circuits

Trouble Shoot, Clamping Circuits

Trouble Shoot, SCR and Triac Switching Circuits

Troulbe Shoot, Single Phase Circuits

Trouble Shoot, Three Phase Circuits

Trouble Shoot, Converters, Inverters, and Dynamotor

Trouble Shoot, Motor Speed Regulators

Trouble Shoot, Transducers

Trouble Shoot, Thermistors

Trouble Shoot, Time-Delay Relays

Trouble Shoot, Electronic Timer Circuits

Trouble Shoot, Photoelectric Devices

Trouble Shoot, Circuits which use Photoconductive Cells

Trouble Shoot, Photo Diodes

Trouble Shoot, Photo Transistors

Trouble Shoot, Light Activated SCR's

Trouble Shoot, Optocouplers

Perform Attenuation Measurements

Perform Phase-Shift Measurements

ELT 131 - 5 hours - Electronic Concepts I

Covers the characteristics and parameter of transistors and vacuum tubes, including temperature effects, light effects, biasing, load lines, amplification, equivalent circuits, frequency response and stability. Other subjects studied are: Feedback, oscillators, power supplies, wide band amplifiers, resonant amplifiers, radio frequency voltage and power amplifiers.

Use a Transistor Voltmeter

Use a Impedance Bridge

Use a Tube Tester

Use a Transistor Checker

Use an Audio Frequency Signal Generator

Use a Radio Frequency Signal Generator

Use a Frequency Counter

Use a Sweep Generator

Use Transistor Parameters

Use Equivalent Circuits

Use Characteristic Curves

Use Transistor Biasing Techniques

Use Load Lines AC/DC

Determine Semiconductor Amplifier Gain

Determine Transistor Noise, Amplifier Noise, or Oscillator Noise

Measure Decibels

Measure DC Amplifier Gain

Measure Frequency Response

Measure Current, Voltage, and Power Gain

Measure Emitter Collector Phase Relationship

Trouble Shoot, Resonant Filter Circuits

Trouble Shoot, PN Junction Diode Circuits

Trouble Shoot, Point Contact Type Diode Circuits

Trouble Shoot, Zeners Diode Circuits

Trouble Shoot, Tunnel Diode Circuits

Trouble Shoot, Photo Diode Circuits

Trouble Shoot, Variable Capacitance Diode Circuits

Trouble Shoot, Hall Effect Device Circuits

Trouble Shoot, Junction Type Transistor Circuits

Trouble Shoot, Photo Transistor Circuits

Trouble Shoot, Power Transistor Circuits

Trouble Shoot, Unijunction Transistor Circuits

Trouble Shoot, Thyristor Circuits

Trouble Shoot, Field Effect Transistor Circuits

ELT 131 - 5 hours - Electronic Concepts I (continued)

Trouble Shoot, Attenuator Circuits

Trouble Shoot, RC Phase Shift Oscillators

Trouble Shoot, Common Emitter, Common Collector, or Common Base Configuration Type Circuits

Trouble Shoot, Push-Pull Amplifier Circuits

Trouble Shoot, RC Coupled Audio Amplifier

Trouble Shoot, Bridged Power Amplifier Circuits

Trouble Shoot, Tuned Amplifier Circuits

Trouble Shoot, Phase Inverters

Trouble Shoot, Modulation, Mixing, or Detection Circuits

Trouble Shoot, AGC Circuits

Trouble Shoot, Waveform Generator Circuits

Trouble Shoot, Diode and Triode Switching

Trouble Shoot, Free Running Multivibrator Circuits

Trouble Shoot, Bistable Multivibrator Circuits

Trouble Shoot, Gating Circuits

Trouble Shoot, Pulse Generator Circuits

Trouble Shoot, Pulse Amplifier Circuits

Trouble Shoot, Linear Wave Shaping Circuits

Trouble Shoot, Null Detector Circuits

Trouble Shoot, Limiting Circuits

Trouble Shoot, Clamping Circuits

Trouble Shoot, Diode Clipper Circuits

Trouble Shoot, Sawtooth Wave Form Circuits

Trouble Shoot, Transistor Sweep Generator Circuits

Lay out Printed Circuit Boards

Make Printed Circuit Boards

Use Written Communications

Write Technical Reports

Trouble Shoot, Automatic Crossover

Trouble Shoot, Clock Chips

Perform Attenuation Measurements

Perform Noise Measurements

Study of high frequency oscillator circuits, radio frequency voltage amplifiers, modulation and demodulation circuits, radio frequency power amplifiers, and antenna theory. The laboratory is correlated with lectures and emphasizes the investigation and design of communication circuits. Microwave electronics is also studied.

Use a Impedance Bridge

Use a Radio Frequency Signal Generator

Use a Frequency Counter

Use a Pulse Generator

Use a Transistor Parameters

Use Operational Amplifier

Use Operational Amplifier in Different Configurations

Determine Operational Amplifier Gain

Measure Decibels

Measure AC Amplifier Gain

Measure Frequency Response

Trouble Shoot, Attenuator Circuits

Trouble Shoot, Voltage Controlled Oscillator

Trouble Shoot, Common Emitter, Common Collector, or Common Base Configuration Type Circuits

Trouble Shoot, Bridged Power Amplifier Circuits

Trouble Shoot, IC Type Power Amplifier Circuits

Trouble Shoot, Phase Inverters

Trouble Shoot, Pulse Generator Circuits

Trouble Shoot, Triggering Circuits

Trouble Shoot, Pulse Counter Circuits

Trouble Shoot, Limiting Circuits

Trouble Shoot, Clamping Circuits

Trouble Shoot, Sawtooth Wave Form Circuits

Trouble Shoot, Transistor Sweep Generator

Lay out Printed Circuit Boards

Make Printed Circuit Boards

Use Written Communications

Write Technical Reports

Trouble Shoot, Automatic Crossover

Trouble Shoot, Transistor Current Regulators

Trouble Shoot, Inverters or Switching Power Supplies, e.g., Stepdown, Feedforward, Stepup, Flyback

Trouble Shoot, Clock Chips

Trouble Shoot, Linear IC'S (OP-AMPS)

Perform Attenuation Measurements.

TASK EVALUATION SHEET

INSTRUCTIONS:	IMPORTANCE OF THE TASK							FREQUENCY OF USE						
If the task is irrelevant to the work your employees do then circle '0' and proceed to the next task. If the task is relevant to the work that you expect from your employees then circle one number from 1 to 6 to indicate the relative importance of the task, and also circle one number from 7 to 13 to indicate how frequently the task is normally executed. If the task described is primarily used or needed as background knowledge then circle number 8.	0 NOT RELEVANT TO THE WORK WE DO	1 VERY IMPORTANT	2 IMPORTANT	3 FAIRLY IMPORTANT	4 OF MINOR IMPORTANCE	5 UNIMPORTANT	6 NOT REQUIRED AS AN ENTRY LEVEL SKILL	7 NEVER USED	8 BACKGROUND KNOWLEDGE OR SKILL	9 ONCE PER MONTH OR LESS	10 ONCE PER MONTH TO ONCE PER WEEK	11 ONCE PER DAY TO ONCE PER WEEK	12 SEVERAL TIMES DAILY	13 HOURLY OR MORE
TASK AREA: energy audits														
TASKS:														
Performing a short walk-through residential energy audit.	0	1	2	3	4	5	6	7	8	9	10	11	12	1
		1	3	1					2		1		2	
Performing a short walk-through commercial or institutional energy audit.	0	1	2	3	4	5	6	7	8	9	10	11	12	1
Performing a thorough residential energy audit.	0	1	2	3	4	5	6	7	8	9	10	11	12	1
1	1	3						1	1	1			1	
Performing a thorough commercial energy audit.	0	1	2	3	4	5	6	7	8	9	10	11	12	1
	2	2	1						1	1			3	
Performing an energy audit, following a particular format. (specify) _____	0	1	2	3	4	5	6	7	8	9	10	11	12	1
1	1	2	1						2		2			
Performing an energy audit using a computer as part of the audit process.	0	1	2	3	4	5	6	7	8	9	10	11	12	1
1	1												1	
Running a computer to perform heating or cycling load calculations.	0	1	2	3	4	5	6	7	8	9	10	11	12	1
1	2	1		1					1			1	2	
Preparing a formal written energy audit report.	0	1	2	3	4	5	6	7	8	9	10	11	12	1
1	1	2		1					2			1	1	
Determining ways to reduce energy costs (as a part of the job description).	0	1	2	3	4	5	6	7	8	9	10	11	12	1
1	3	1							1		2		1	
Evaluating the cost-effectiveness of energy conservation options.	0	1	2	3	4	5	6	7	8	9	10	11	12	1
Explaining energy audit findings to a customer or client.	0	1	2	3	4	5	6	7	8	9	10	11	12	1
		4	1								1	1	3	
Explaining energy audit findings to a supervisor or co-worker.	0	1	2	3	4	5	6	7	8	9	10	11	12	1
1	3	1							1		1	1	1	
Providing other energy conservation evaluation tasks. (specify) _____	0	1	2	3	4	5	6	7	8	9	10	11	12	1
1	3	1								1	1		2	
	0	1	2	3	4	5	6	7	8	9	10	11	12	1

ELT 133 - 4 hours - Rotating Machinery

The study of DC and AC machines to include single phase and three phase motors and generators. Basic controls and loading devices are also covered. Experiments include braking, static and dynamic loading, electromagnetism transformer studies.

Trouble Shoot, Thyristor Circuits

Trouble Shoot, Common Emitter, Common Collector, or Common Base Configuration Type Circuits

Trouble Shoot, SCR and Triac Switching Circuits

Trouble Shoot, AC and DC Generators

Trouble Shoot, AC and DC Motors

Trouble Shoot, Single Phase Circuits

Trouble Shoot, Converters, Inverters, and Dynamotor

Trouble Shoot, Motor Speed Regulators

Trouble Shoot, Automatic Motor Controls

Trouble Shoot, Common Servomechanism Systems

Trouble Shoot, Control Transformers

Trouble Shoot, Electronic Motor Control System

Trouble Shoot, Electronic Timer Circuits

Trouble Shoot, SCR and Triac Motor Control Circuits

Use Written Communications

Write Technical Reports

Trouble Shoot, Device Controllers, e.g., Disk, Keyboard, Display (CRT) Printers

Trouble Shoot, Buss Systems, e.g., S-100, IEEE-488, IEEE-583 CAMAC, EIA-RS232C, EIA-RS422

Trouble Shoot, Interface Chip Circuits, e.g., UART, PIO, DMAC, PIC, PIT, PIA, CTC

Trouble Shoot, Linear IC'S (OP-AMPS)

II. TASK ANALYSIS SURVEY
ALTERNATIVE ENERGIES

The research that we did in Phase I of this project has shaped the manner in which the task analysis for Phase II of this program was prepared. Our explorations in phase I showed that the energy conservation and solar industries are in periods of rapid transition. We found that those educational institutions that had specialized in providing narrowly focused vocational training had difficulty in surviving. Those institutions that we surveyed and visited that have had the most success in maintaining their programs, and in placing their students, were those institutions that had diversified their curriculums. Most of these programs emphasized more generalized and diverse energy educations, rather than educating their students in narrow vocational areas. Their students were placed in a wide variety of jobs in the energy fields.

The committee selected for assisting in developing a relevant energy curriculum was selected with the idea of maintaining a diverse group of potential employers and others who would, as a group, have a varied view of the skills needed for energy profesionals. Committee members were selected who are exerienced and work in: residential and commercial energy auditing, residential construction, weatherization in a rural setting, weatherization in an urban setting, sales, installation, and service of energy management equipment, sales and installation of solar and energy conservation equipment, a state energy agency, and educational institutions running a solar energy program and a energy conservation and solar program with an electronics emphasis.

The tasks presented to the committee for their feedback and

evaluation were developed by researching; existing energy and solar energy curriculums, references and texts on related topics, and by discussing the tasks with committee members and others.

The tasks that were selected to send to the committee cover a diversity of topics and potential job skills. Each member was asked to look over all of the tasks. They were also asked to indicate if the task was irrelevant to the work that they normally expect their employees to do. Because most of the evaluators are employers in a fairly narrow field, they predictably found that certain blocks of related skills were very important, and that many of the others tasks were essentially not relevant as a task that they would normally expect their employees to perform. Because of this specialization, a number of tasks were important to only one or two evaluators. However, that one evaluator may represent many other potential employers in a particular job market. It therefore becomes important to consider the importance of a task along with the potential job market in that particular task area. The manner in which a task analysis survey is often evaluated is to statistically compare the responses to each task. Those tasks that have higher numbers of respondents indicating that the particular task is important and frequently used, are those tasks that are given priority for inclusion in the curriculum. To use this type of straight-forward statistical approach in evaluating these tasks could result in some misleading conclusions being reached. Therefore we have chosen not to evaluate the surveys statistically. We have on the other hand, reviewed them individually and as a group quite carefully. We have also balanced them with the job market and the experiences of other educational institutions. The actual responses of the

comittee members are available upon request.

In reviewing the responses of the committee, it was found that the foundations of energy fundamentals, and energy auditing were important to most respondents, except those who did weatherization work only. These items will be the core of the entry level courses. Some tasks that have a very low incidence of use or importance have been eliminated. Also some of those tasks that are specialized, specific to only a few workplaces, and that could easily be handled in on-the-job training, or are better taught in other vocational programs, have been eliminated. Of those specialized tasks that remain, such as installation tasks, it is proposed to teach these skills in a general manner so that undue time is not wasted in learning a particular installation technology that may soon be obsolete, or may differ substancially from the techniques used by the employer. The emphasis is to be placed in giving the learner a good overview of the techniques and technologies so that the time expended in on-the-job training with the future employer will be minimized. A list of courses with the tasks sorted into the courses follows. More courses are listed than would fit into a program that is an option to an electronics program. The additional courses indicate directions for future expansion of the program. They could also be used to provide a wider selection of options for students in the program, and they could be used as useful service courses for students majoring in other areas who coud benefit from a practical background in energy conservation, energy auditing, or renewable energy technologies.

ADVISORY COMMITTEE - ALTERNATIVE ENERGIES

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III. TASK SURVEY INSTRUCTIONS

Please review the following lists of tasks. The purpose of this survey is to determine if the tasks are normally performed by your employees, or if you anticipate that they will be performed by your employees in the near future. If the task is not relevant to your workplace or outside of your experience, please circle 0 and move on to the next item. If an entire page is on a topic that is not relevant to your workplace or your experience, simply put a big loop around all of the 0's and move on to the next page.

If the task is relevant to your workplace please then assess its importance, and then assess its frequency of use. The survey is to serve as a guide in our curriculum development. You should not spend a lot of time making fine discriminations about a tasks relative importance or the exact frequency of use. Also if a task description resembles something your employees do or need to know, but is not exactly the same, please go ahead and evaluate it. It is difficult to make universally applicable task descriptions. Feel free to make notes and comments on the task evaluation sheets and to make more general comments and observations. Those evaluators who are not employers should evaluate the tasks based on their experience and knowledge in the task areas.

The evaluation rating scales are:

IMPORTANCE OF THE TASKS

NOT RELEVANT TO THE WORK WE DO (select this if the task is not relevant to work your employees do or you anticipate they will do in the near future.)

1 VERY IMPORTANT
2 IMPORTANT
3 FAIRLY IMPORTANT
4 OF MINOR IMPORTANCE
5 UNIMPORTANT
6 NOT REQUIRED AS AN ENTRY LEVEL SKILL (select this if you think the task is relevant to the work expected of your employees but it is not an entry level skill.)

FREQUENCY OF USE

7 NEVER USED
8 BACKGROUND KNOWLEDGE OR SKILL (select this if it is needed as background knowledge or as an important skill that may not be used often.)
9 ONCE PER MONTH OR LESS
10 ONCE PER MONTH TO ONCE PER WEEK
11 ONCE PER DAY TO ONCE PER WEEK
12 SEVERAL TIMES DAILY
13 HOURLY OR MORE

Keeping this instruction sheet nearby will make filling out the task evaluation sheet easier.

TASK EVALUATION SHEET

INSTRUCTIONS:

If the task is irrelevant to the work your employees do then circle '0' and proceed to the next task. If the task is relevant to the work that you expect from your employees then circle one number from 1 to 6 to indicate the relative importance of the task, and also circle one number from 7 to 13 to indicate how frequently the task is normally executed. If the task described is primarily used or needed as background knowledge then circle number 8.

TASK AREA: energy

TASKS:	IMPORTANCE OF THE TASK							FREQUENCY OF USE						
	0 NOT RELEVANT TO THE WORK WE DO	1 VERY IMPORTANT	2 IMPORTANT	3 FAIRLY IMPORTANT	4 OF MINOR IMPORTANCE	5 UNIMPORTANT	6 NOT REQUIRED AS AN ENTRY LEVEL SKILL	7 NEVER USED	8 BACKGROUND KNOWLEDGE OR SKILL	9 ONCE PER MONTH OR LESS	10 ONCE PER MONTH TO ONCE PER WEEK	11 ONCE PER DAY TO ONCE PER WEEK	12 SEVERAL TIMES DAILY	13 HOURLY OR MORE
Defining how heat is transferred by conduction.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	3							3			1		
Defining how heat is transferred by convection.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	3							3			1		
Defining how heat is transferred by radiation.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	3							3			1		
Defining four forms of energy (example: electrical, chemical, mechanical, etc.)	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1		1	2					4					
Explaining the Law of Conservation of Energy	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	2	1						4					
Defining the terms renewable and non-renewable energy.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	2	1						3				1	
Listing the proportions of energy used for different residential applications.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	1	1	1	1				2	1			1	
Drawing a time line showing the projected supply curves for natural gas, oil, & coal.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1		2	1	1				3	1				
Explaining the role of energy conservation in reducing dependence on fossil fuels.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	3							3		1			
Explaining the role of renewable energy in reducing dependence on fossil fuels.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	3							4		1			
Explaining the role of renewable energy and energy conservation in creating jobs.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	2	1	1					2	1	1			
Defining 'R' value.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	3		1					1	1	1		1	
Defining 'U' value.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	3		1					1	1	1		1	

TASK EVALUATION SHEET

INSTRUCTIONS:

If the task is irrelevant to the work your employees do then circle '0' and proceed to the next task. If the task is relevant to the work that you expect from your employees then circle one number from 1 to 6 to indicate the relative importance of the task, and also circle one number from 7 to 13 to indicate how frequently the task is normally executed. If the task described is primarily used or needed as background knowledge then circle number 8.

TASK AREA: energy calculations

TASKS:	IMPORTANCE OF THE TASK							FREQUENCY OF USE						
	0 NOT RELEVANT TO THE WORK WE DO	1 VERY IMPORTANT	2 IMPORTANT	3 FAIRLY IMPORTANT	4 OF MINOR IMPORTANCE	5 UNIMPORTANT	6 NOT REQUIRED AS AN ENTRY LEVEL SKILL	7 NEVER USED	8 BACKGROUND KNOWLEDGE OR SKILL	9 ONCE PER MONTH OR LESS	10 ONCE PER MONTH TO ONCE PER WEEK	11 ONCE PER DAY TO ONCE PER WEEK	12 SEVERAL TIMES DAILY	13 HOURLY OR MORE
Locking up the 'R' value of a given thickness of a given material.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
		1	3						1			1	2	
Calculating the total 'U' value of a given wall, ceiling, or building section.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	1	2						2				1	
Defining Δ T delta T or change in temperature.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	1	2	1					2	1				
Calculating the heat loss in BTU's at a given Δ T for a given building section.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	1	2	1						1			2	
Defining the term "Degree Days".	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	2	1	1					2	1				
Calculating the number of "Degree Days" given a set of daily temperature records.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	1	1	2					1	1			1	
Calculating the heat loss for a given wall section, and local climatic data.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	1	2						2				1	
Defining the term 'air changes per hour'.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	1	2						2				1	
Calculating the heat loss due to air infiltration given weather and building data.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	1	2						1				2	
Calculating the heat loss in BTUH from the edge of a concrete slab floor.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	1	2						1				2	
Calculating the net annual heat loss in BTU's for a residential structure.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	1	2						1				2	
Calculating the net annual heat loss in BTU's for a commercial structure.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	1	2						2				1	
Calculating the heat gain through a south-facing window.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1		3						2				1	

BEST COPY AVAILABLE

TASK EVALUATION SHEET

INSTRUCTIONS:

If the task is irrelevant to the work your employees do then circle '0' and proceed to the next task. If the task is relevant to the work that you expect from your employees then circle one number from 1 to 6 to indicate the relative importance of the task, and also circle one number from 7 to 13 to indicate how frequently the task is normally executed. If the task described is primarily used or needed as background knowledge then circle number 8.

TASK AREA: energy calculations

TASKS:	IMPORTANCE OF THE TASK							FREQUENCY OF USE					
	0 NOT RELEVANT TO THE WORK WE DO	1 VERY IMPORTANT	2 IMPORTANT	3 FAIRLY IMPORTANT	4 OF MINOR IMPORTANCE	5 UNIMPORTANT	6 NOT REQUIRED AS AN ENTRY LEVEL SKILL	7 NEVER USED	8 BACKGROUND KNOWLEDGE OR SKILL	9 ONCE PER MONTH OR LESS	10 ONCE PER MONTH TO ONCE PER WEEK	11 ONCE PER DAY TO ONCE PER WEEK	12 SEVERAL TIMES DAILY
Calculating the heat gain through an east or west facing window.	0	1	1		1				3				1
Defining the terms 'sensible and latent heat'.	0	1	1	1					3		1		
Calculating the internal sensible heat gains in a residential structure.	0		2	1					2		1		1
Calculating the internal sensible heat gains in a commercial structure.	0		2	1					2		1		1
Calculating the latent heat gains in a residential or commercial structure.	0		1	2					2	1			1
Calculating the net seasonal cooling requirements of a residential building.	0		1	1					2		1		
Calculating the net seasonal cooling requirements of a commercial structure.	0		1	2					1	1			1
Preparing building load calculations using the ASHRAE degree day method.	0		2		1				2		1		1
Preparing building load calculations using the EIN method.	0		1		1		1	1	2				1
Preparing building load calculations using the (specify) method.	0		1					1					1
Explaining the term peak combustion efficiency.	0		3						2		1		1
Explaining the term AFUE (annual fuel utilization efficiency).	0	1	1						1		1		1
Explaining the term EER (energy efficiency ratio).	0		3	1					1	2		1	
	0												

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TASK EVALUATION SHEET

INSTRUCTIONS:	IMPORTANCE OF THE TASK							FREQUENCY OF USE						
If the task is irrelevant to the work your employees do then circle '0' and proceed to the next task. If the task is relevant to the work that you expect from your employees then circle one number from 1 to 6 to indicate the relative importance of the task, and also circle one number from 7 to 13 to indicate how frequently the task is normally executed. If the task described is primarily used or needed as background knowledge then circle number 8.	0 NOT RELEVANT TO THE WORK WE DO	1 VERY IMPORTANT	2 IMPORTANT	3 FAIRLY IMPORTANT	4 OF MINOR IMPORTANCE	5 UNIMPORTANT	6 NOT REQUIRED AS AN ENTRY LEVEL SKILL	7 NEVER USED	8 BACKGROUND KNOWLEDGE OR SKILL	9 ONCE PER MONTH OR LESS	10 ONCE PER MONTH TO ONCE PER WEEK	11 ONCE PER DAY TO ONCE PER WEEK	12 SEVERAL TIMES DAILY
TASK AREAS: heating/cooling systems, peak load management. TASKS:													
Explaining the function of flue modification devices.	0 1	1	1 2	2	3	4	5 6	7	8 1	9	10 1	11 1	12 1
Recognizing common safety hazards of gas and oil furnaces.	0 1	1 2	1	2	3	4	5 6	7	8 1	9	10 1	11	12 2
Testing the peak combustion efficiency of a gas furnace.	0 1	1 1	1 1	2 1	3	4	5 6	7 1	8 2	9	10	11	12 1
Testing the peak combustion efficiency of an oil furnace.	0 1	1	2 2	3 1	4	5	6	7 1	8 2	9	10 1	11	12
Testing the peak combusiton efficiency of a coal furnace.	0 3	1	2	3	4 1	5	6	7 1	8 1	9	10 1	11	12
Checking the amperage drawn by an air-conditioning unit.	0 2	1 1	1	2	3 1	4	5 6	7 1	8 2	9	10 1	11	12
Explaining the vapor compression air-conditioning cycle.	0 2	1	2 1	3	4 1	5	6	7 1	8	9	10	11	12
Calculating the fuel needed for heating given the system efficiency and heating load.	0 1	1	2 2	2	3	4	5 6	7	8 1	9 1	10 1	11	12 1
Calculating the fuel needed for cooling given the system efficiency and cooling load.	0 1	1	2 1	2	3	4	5 6	7	8 2	9 1	10	11 1	12
Calculating the energy savings from switching incadescent to fluorescent lighting.	0 1	1	2 1	2	3 1	4	5 6	7	8 1	9 2	10	11	12
	0	1	2	3	4	5	6	7	8	9	10	11	12
Explaining the cost savings that can be attained by using peak load management.	0 1	1 1	2	2	3	4 1	5 6	7	8 1	9 1	10	11 1	12 1
Specifying and/or designing peak load management systems.	0 1	1 1	1	2	3	4 1	5 6 1	7 1	8 1	9	10 1	11 1	12
Installing peak load management systems.	0 1	1 1	1	2	3 1	4	5 6	7 1	8 1	9	10 2	11	12

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TASK EVALUATION SHEET

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TASK AREAS: ventilation, vapor barriers, thermostats, weatherization.

TASKS:	IMPORTANCE OF THE TASK							FREQUENCY OF USE						
	0 NOT RELEVANT TO THE WORK WE DO	1 VERY IMPORTANT	2 IMPORTANT	3 FAIRLY IMPORTANT	4 OF MINOR IMPORTANCE	5 UNIMPORTANT	6 NOT REQUIRED AS AN ENTRY LEVEL SKILL	7 NEVER USED	8 BACKGROUND KNOWLEDGE OR SKILL	9 ONCE PER MONTH OR LESS	10 ONCE PER MONTH TO ONCE PER WEEK	11 ONCE PER DAY TO ONCE PER WEEK	12 SEVERAL TIMES DAILY HOURLY OR MORE	13
Describing the proper location for a vapor barrier in a wall and in a ceiling.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	2	2								1	1	2	
Describing the proper use of a vapor barrier in a crawl space.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
		1	3	1						2	1	1	2	
Calculating the proper ventilation for attics.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	2	1	1						1			3	
Calculating the proper ventilation for crawl spaces.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	2	1		1			1			1		3	
Calculating the proper size for a whole house ventilating fan.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1		1	2			1			1		2		
Listing and explaining at least 6 low-cost ways to reduce utility costs.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	2	1								1		2	
Explaining the function of a set-back thermostat.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	2	2								1		2	
Installing a set-back thermostat.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	1	1	2				1	2		1	1		
Describing 3 types of weatherstripping for doors or windows.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	1	3						2			1	2	
Selecting the proper types of weatherstripping for doors and windows.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	2	2						1				3	
Installing weatherstripping on doors.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	1		2	1				2		1		1	
Describing the function of outlet gaskets.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	1	2	1					1			1	2	
Installing weatherstripping on windows.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	1		2	1				2		1		1	
	0	1	2	3	4	5	6	7	8	9	10	11	12	13

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TASK EVALUATION SHEET

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TASKS:														
Installing outlet gaskets.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1		1	3					2		1	1		
Describing the functin of a hot water heater insulating jacket.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
		1	3	1						1		1	2	
Installing a hot water heater jacket.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	1	1	2					2				2	
Measuring for storm windows or storm doors.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	2	1			1		1					3	
Installing plastic storm windows.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1			2		2			3		1			
Installing glass storm windows.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	1		2		1		1	1		1		1	
Describing 5 common types of caulk and their proper use and application.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	1	3								1		3	
Selecting the proper type of caulk for a particular installation.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	1	2	1					1	1			2	
Applying caulking to doors, windows, and cracks.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	1		2	1				2		1			
Listing 5 common types of insulation and their proper uses.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	3	1								1		3	
Selecting the proper types of insulations for various applications.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	2	1	1					1		1		2	
Installing fiberglass batt insulation.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	1		2	1				2		1		1	
Installing storm doors.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	1		2		1		1	1	1			1	
	0	1	2	3	4	5	6	7	8	9	10	11	12	13

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TASKS:														
Installing blown cellulose insulation.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1			2		1			2		1			
Installing blown rock wool insulation.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1			2		1			2		1			
Installing foam board insulation.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1		1	1		1			2		1			
Installing plastic vapor barriars.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1		1	1		1			2		1			
Installing wood burning stoves.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1			1	1	1			2		1			
Installing mobile home underpinning.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	2				1	1			2					
Installing replacement windows.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1			2		1			2		1			
Installing replacement doors.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1			2		1			2		1			
Installing other weatherization materials. List below with importance and frequencies:	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	2													
	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	0	1	2	3	4	5	6	7	8	9	10	11	12	13

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TASK AREA: solar radiation, site selection, solar collectors.														
TASKS:														
Defining beam and diffuse radiation.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
		3	1	1						3		1	1	
Locating and using sources of solar data.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	2								1			1	
Determining the amount of solar radiation available at a given location at a given time.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	2								2	1				
Explaining the importance of the angle of incidence on the solar energy available.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	2		2	1					2	1				
Explaining the importance of solar absorptivity.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	2		2	1					2	1				
Explaining the importance of solar reflectivity.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	2	1	1	1					2	1				
Explaining how the different solar altitude and aximuth angles effect solar performance.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	2		2	1					2	1				
Preparing a solar site analysis.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	2		2	1					2	1				
Defining the difference between active and passive solar energy systems.	0	1	2	3	4	5	6	7	8	9	10	11	12	1
	2	1	2	1					2	1				
Listing the advantages and disadvantages of active and passive solar energy systems.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	2		3							1			2	
Explaining the differences between flat plate, concentrating, and tracking collectors.	0	1	2	3	4	5	6	7	8	9	10	11	12	1
	2	1	2						2				1	
Listing 5 major factors effecting solar collector performance.	0	1	2	3	4	5	6	7	8	9	10	11	12	1
	2		3							1			2	
Identifying the functions of the major parts of a solar collector.	0	1	2	3	4	5	6	7	8	9	10	11	12	1
	2	1	1	1					2	1				
	0	1	2	3	4	5	6	7	8	9	10	11	12	1

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TASK AREA: solar collectors, domestic hot water.

TASKS:	IMPORTANCE OF THE TASK							FREQUENCY OF USE						
	0 NOT RELEVANT TO THE WORK WE DO	1 VERY IMPORTANT	2 IMPORTANT	3 FAIRLY IMPORTANT	4 OF MINOR IMPORTANCE	5 UNIMPORTANT	6 NOT REQUIRED AS AN ENTRY LEVEL SKILL	7 NEVER USED	8 BACKGROUND KNOWLEDGE OR SKILL	9 ONCE PER MONTH OR LESS	10 ONCE PER MONTH TO ONCE PER WEEK	11 ONCE PER DAY TO ONCE PER WEEK	12 SEVERAL TIMES DAILY	13 HOURLY OR MORE
Defining solar collector efficiency.	0	1	2	3	4	5	6	7	8	9	10	11	12	1
	2		2		1				1		1		1	
Defining whole system efficiency.	0	1	2	3	4	5	6	7	8	9	10	11	12	1
	2		3						2	1				
Describing the important parts and operation of a closed loop solar DHW system.	0	1	2	3	4	5	6	7	8	9	10	11	12	1
	2			1					2	1				
Describing the important parts and operation of a drain back solar DHW system.	0	1	2	3	4	5	6	7	8	9	10	11	12	1
	2		2	1					2	1				
Describing the important parts and operation of a drain down solar DHW system.	0	1	2	3	4	5	6	7	8	9	10	11	12	1
	2		2	1					1	1			1	
Describing the important parts and operation of a thermospyphon solar DHW system.	0	1	2	3	4	5	6	7	8	9	10	11	12	1
	2		2	1					1	1			1	
Describing the important parts and operation of a passive or batch DHW system.	0	1	2	3	4	5	6	7	8	9	10	11	12	1
	2		2	1					1	1			1	
Describing the important parts and operation of a freon-type solar DHW system.	0	1	2	3	4	5	6	7	8	9	10	11	12	1
	2		3						1	1			1	
Comparing the advantages and disadvantages of the different solar DHW systems.	0	1	2	3	4	5	6	7	8	9	10	11	12	1
	2		3						1	1			1	
Listing 4 commonly used heat transfer fluids and their proper applications.	0	1	2	3	4	5	6	7	8	9	10	11	12	1
	2		2	1					1	1			1	
Describing the function of heat storage in solar collector operation.	0	1	2	3	4	5	6	7	8	9	10	11	12	1
	2		3						2				1	
Describing the advantages and disadvantages of air and water systems.	0	1	2	3	4	5	6	7	8	9	10	11	12	1
	2		1	2					2	1				
Defining front pass and back pass collector types.	0	1	2	3	4	5	6	7	8	9	10	11	12	1
	2		2	1					2	1				
	0	1	2	3	4	5	6	7	8	9	10	11	12	1

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TASK AREA: solar domestic hot water systems.

TASKS:	IMPORTANCE OF THE TASK							FREQUENCY OF USE						
	0 NOT RELEVANT TO THE WORK WE DO	1 VERY IMPORTANT	2 IMPORTANT	3 FAIRLY IMPORTANT	4 OF MINOR IMPORTANCE	5 UNIMPORTANT	6 NOT REQUIRED AS AN ENTRY LEVEL SKILL	7 NEVER USED	8 BACKGROUND KNOWLEDGE OR SKILL	9 ONCE PER MONTH OR LESS	10 ONCE PER MONTH TO ONCE PER WEEK	11 ONCE PER DAY TO ONCE PER WEEK	12 SEVERAL TIMES DAILY	13 HOURLY OR MORE
Describing and explaining the functioning of vertical well solar collectors.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	2		3						1		1		1	
Sizing domestic hot water solar heating systems.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	2		1	2					2	1				
Selecting components for domestic hot water solar heating systems.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	2	1	1	1							2			
Sizing pump for domestic hot water solar heating systems.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	2		1	2					1	1			1	
Preparing an economic analysis for solar domestic hot water systems.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	2			3					1	1		1		
Preparing an annual cash flow analysis for domestic hot water systems.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	2			3					2			1		
Installing solar domestic hot water systems.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	2		2	1					1		1		1	
Transporting and fastening the collector(s) in place for solar DHW systems.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	2		2	1					1	1			1	
Connecting the pipes and fittings needed for the installation of solar DHW systems.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	2			2	1				2			1		
Installing the electronic controls, wiring and sensors for solar DHW systems.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	2		1	1	1				2			1		
Filling solar DHW systems with heat transfer fluid.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	2		1		2				2			1		
Testing solar DHW system for proper operation.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	2		1		2				2			1		
Performing other important components of system installation. (specify) _____	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	2		1		2				2			1		
	0	1	2	3	4	5	6	7	8	9	10	11	12	13

TASK EVALUATION SHEET

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TASKS:														
Designing whole house solar space heating systems.	0 2	1	2 2	3	4 1	5	6	7	8 2	9	10	11 1	12	1
Installing whole house solar space heating systems.	0 3	1	2	3	4	5	6	7	8	9	10	11	12	1
Installing air source heat pump systems for space heating and cooling.	0 2	1	2 1	3 1	4	5 1	6	7	8 1	9	10 1	11	12	1
Installing water source heat pump systems for space heating and cooling.	0 2	1	2 1	3	4 1	5 1	6	7	8 1	9	10 1	11	12	1
Installing heat pump systems for domestic hot water heating.	0 2	1	2	3 1	4 1	5 1	6	7 1	8	9	10 1	11	12	1
Calculating the total amount of heat loss occurring from a swimming pool.	0 2	1	2	3 2	4 1	5	6	7 1	8	9	10 1	11	12	1
Calculating pool heat loss due to convection, evaporation, and nocturnal radiation.	0 2	1	2 1	3 1	4 1	5	6	7 1	8	9	10 1	11	12	1
Listing three methods to reduce heat loss from swimming pools.	0 2	1	2 1	3 1	4 1	5	6	7	8 1	9	10	11 1	12	1
Sizing swimming pool or spa solor heating systems.	0 2	1	2 1	3 1	4	5 1	6	7	8 1	9	10	11 1	12	1
Specifying components for solar pool heating systems.	0 2	1	2 2	3 1	4	5	6	7	8	9 1	10	11 1	12	1
Installing solar pool heating systems.	0 2	1	2 1	3 2	4	5	6	7	8	9 1	10	11 1	12	1
Running a computer program to perform active solar computations or performance predictions.	0 2	1	2 1	3 1	4 1	5	6	7	8 1	9	10	11 1	12	1
	0	1	2	3	4	5	6	7	8	9	10	11	12	1
	0	1	2	3	4	5	6	7	8	9	10	11	12	1

TASK EVALUATION SHEET

INSTRUCTIONS:	IMPORTANCE OF THE TASK	FREQUENCY OF USE
If the task is irrelevant to the work your employees do then circle '0' and proceed to the next task. If the task is relevant to the work that you expect from your employees then circle one number from 1 to 6 to indicate the relative importance of the task, and also circle one number from 7 to 13 to indicate how frequently the task is normally executed. If the task described is primarily used or needed as background knowledge then circle number 8. TASK AREA: passive solar systems	0 NOT RELEVANT TO THE WORK WE DO 1 VERY IMPORTANT 2 IMPORTANT 3 FAIRLY IMPORTANT 4 OF MINOR IMPORTANCE 5 UNIMPORTANT 6 NOT REQUIRED AS AN ENTRY LEVEL SKILL	7 NEVER USED 8 BACKGROUND KNOWLEDGE OR SKILL 9 ONCE PER MONTH OR LESS 10 ONCE PER MONTH TO ONCE PER WEEK 11 ONCE PER DAY TO ONCE PER WEEK 12 SEVERAL TIMES DAILY 13 HOURLY OR MORE
TASKS:		
Explaining the characteristics and the operation of direct gain solar systems.	0 1 **2** 3 4 5 6	7 **8** 9 10 **11** 12 13
Explaining the characteristics and the operation of Trombe Wall Solar systems.	0 1 2 3 4 5 6 3	7 8 9 10 11 12 13
Explaining the characteristics and the operation of water wall solar systems.	0 1 **2** 3 4 5 6	7 **8** 9 10 **11** 12 13
Explaining the characteristics and the operation of eutectic salt storage systems.	0 1 **2** 3 4 5 6	7 **8** 9 10 **11** 12 13
Explaining the characteristics and the operation of solar greenhouse systems.	0 1 **2** 3 4 5 6	7 **8** 9 10 **11** 12 13
Explaining the importance of balancing the heat gain/loss and storage in passive systems.	0 1 **2** 3 4 5 6	7 **8** 9 10 **11** 12 13
Describing the functions of solar greenhouses.	0 1 **2** 3 4 5 6	7 **8** 9 10 **11** 12 13
Calculating the solar gain on a clear day through a south glazing.	0 1 **2** 3 4 5 6	7 **8** 9 10 **11** 12 13
Calculating the solar gain on an average day through a south glazing for 1 month.	0 1 **2** 3 4 5 6	7 **8** 9 10 **11** 12 13
Calculating the solar gain for a heating season through a south glazing.	0 1 **2** 3 4 5 6	7 **8** 9 10 **11** 12 13
Calculating the solar contribution for a given building using the Los Alamos method.	0 1 **2** 3 4 5 6	7 **8** 9 10 **11** 12 13
Calculating the solar contribution for a given building using the (specify) _____ method.	0 1 **2** 3 4 5 6	7 **8** 9 10 **11** 12 13
Calculating the heat storage capacity of a given building material.	0 1 **2** 3 4 5 6	7 **8** 9 10 **11** 12 13
	0 1 2 3 4 5 6	7 8 9 10 11 12 13

TASK EVALUATION SHEET

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TASKS:													
Determine the thermal storage requirement of a given passive solar building.	0	1	2	3	4	5	6	7	8	9	10	11	12
	3		1										1
Determining the fan or blower size needed to transfer heat from a solar greenhouse.	0	1	2	3	4	5	6	7	8	9	10	11	12
	2		2		1				1	1		1	
Calculating the internal temperature of a passive solar building under given conditions.	0	1	2	3	4	5	6	7	8	9	10	11	12
	2		2		1				1	1		1	
Determining the proper overhang for a passive solar building.	0	1	2	3	4	5	6	7	8	9	10	11	12
	2		1		2				2			1	
Forming a computer program to perform passive solar calculations or performance predictions.	0	1	2	3	4	5	6	7	8	9	10	11	12
	2		1	2					2				1
	0	1	2	3	4	5	6	7	8	9	10	11	12
	0	1	2	3	4	5	6	7	8	9	10	11	12
	0	1	2	3	4	5	6	7	8	9	10	11	12
	0	1	2	3	4	5	6	7	8	9	10	11	12
	0	1	2	3	4	5	6	7	8	9	10	11	12
	0	1	2	3	4	5	6	7	8	9	10	11	12
	0	1	2	3	4	5	6	7	8	9	10	11	12
	0	1	2	3	4	5	6	7	8	9	10	11	12

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TASK EVALUATION SHEET

INSTRUCTIONS:	IMPORTANCE OF THE TASK							FREQUENCY OF USE						
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TASKS:														
Explaining how local terrain and wind tower height effect available wind speed.	0 2	1	2 2	3 1	4	5	6	7	8 1	9	10 1	11 1	12	1.
Evaluating a site for available wind using an anemometer.	0 2	1	2 1	3 1	4 1	5	6	7	8 1	9	10	11	12 2	1.
Describing the principal types of windmills in common use and their best applications.	0 2	1	2 1	3 1	4 1	5	6	7	8 2	9 1	10	11	12	1.
Explaining the mathematical relation between increased wind speed and increased power.	0 2	1	2	3 1	4 2	5	6	7 1	8 1	9	10 1	11	12	1.
Calculating daily, weekly or monthly electrical load for a client or customer.	0 2	1	2	3 2	4 1	5	6	7	8 1	9 1	10 1	11	12	1.
Sizing a wind power system to fit a customer's or client's needs.	0 2	1	2 2	3 1	4	5	6	7	8 3	9	10	11	12	1
Sizing a photovoltaic electric generating system to fit a customer's or client's needs.	0 2	1	2 1	3 2	4	5	6	7	8 2	9	10	11 1	12	1
Sizing a battery backup system to fit a clients needs.	0 2	1	2 1	3	4 2	5	6	7	8 2	9	10 1	11	12	1
Sizing a back-up generator system to fit a customer's or client's needs.	0 2	1	2 1	3	4 2	5	6	7	8 2	9	10 1	11	12	1
Sizing and specifying DC to AC inverters to fit a customer's or client's needs.	0 2	1	2 1	3	4 2	5	6	7	8 2	9	10 1	11	12	1
Installing wind power systems.	0 2	1	2 1	3	4 2	5	6	7	8 2	9	10 1	11	12	1
Installing photovoltaic electric generating systems.	0 2	1	2 1	3	4 2	5	6	7	8 2	9	10 1	11	12	1
Describing the common types of photovoltaic collectors.	0 2	1	2	3 1	4 1	5 1	6	7 1	8 1	9	10 1	11	12	1
	0	1	2	3	4	5	6	7	8	9	10	11	12	1

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TASKS:														
Installing differential controls for solar systems and heating controls.	0 2	1	2	3 1	4 2	5	6	7	8 2	9	10 1	11	12	1
Installing proportional controllers.	0 2	1	2 2	3	4 1	5	6	7	8 1	9	10 1	11 1	12	1
Troubleshooting and servicing electronic controls for solar systems in the field.	0 2	1	2	3 1	4 1	5 1	6	7	8 2	9	10 1	11	12	1
Troubleshooting and servicing electronic controls for energy management in the field.	0 1	1 1	2	3 1	4 1	5 1	6	7	8 2	9 1	10 1	11	12	1
Repairing electronic controls. (shop repairs vs. unit replacement).	0 2	1	2 1	3 1	4 1	5	6	7	8 2	9	10 1	11	12	1
Interfacing solar or energy management control systems with other HVAC systems.	0 2	1 1	2 1	3	4 1	5	6	7 1	8 1	9	10 1	11 1	12	1
Specifying off the shelf electronic controls for energy management or solar applications.	0 2	1 1	2	3 1	4 1	5	6	7 1	8 1	9 1	10 1	11	12	1
Modifying off the shelf electronic controls for energy management or solar applications.	0 1	1 1	2 1	3 1	4 1	5	6	7	8 2	9 1	10 1	11	12	1
Designing custom electronic controls for energy management or solar systems.	0 1	1 1	2	3 1	4 2	5	6	7	8 2	9 1	10	11 1	12	1
Estimating job costs for installation, repair or design or electronic controls.	0 2	1 1	2	3 1	4 1	5	6	7 1	8 1	9 1	10 1	11	12	1
	0	1	2	3	4	5	6	7	8	9	10	11	12	1
	0	1	2	3	4	5	6	7	8	9	10	11	12	1
	0	1	2	3	4	5	6	7	8	9	10	11	12	1
	0	1	2	3	4	5	6	7	8	9	10	11	12	1

TASK EVALUATION SHEET

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Explaining solar energy systems to clients or customers.	0 2	1 1	2	3	4 2	5	6	7	8 1	9	10 1	11 1	12	13
Explaining energy conservation options to clients or customers.	0 1	1 1	2	3 2	4 1	5	6	7	8 1	9 2	10 1	11	12	13
Explaining cost effectiveness and payback to clients or customers.	0 2	1 1	2 1	3 1	4	5	6	7	8	9	10	11 2	12 1	13
Explaining financing systems to clients or customers.	0 1	1 2	2 2	3	4	5	6	7	8	9	10	11 2	12 2	13
Selling solar energy systems to customers.	0 1	1 2	2 2	3	4	5	6	7	8	9	10 1	11 1	12 2	13
Selling energy management systems to customers.	0 1	1 1	2 2	3 1	4	5	6	7	8	9 2	10	11 1	12 1	13
Selling energy conservation equipment or materials to customers.	0 3	1	2	3 1	4	5 1	6	7 1	8	9 1	10	11 1	12	13
Handling customer sales objections.	0 2	1 1	2	3 1	4	5 1	6	7 1	8	9 1	10	11 2	12	13
Closing sales with customers.	0 2	1 1	2	3 1	4	5 1	6	7 1	8	9 1	10	11 2	12	13
	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	0	1	2	3	4	5	6	7	8	9	10	11	12	13

TASK EVALUATION SHEET

INSTRUCTIONS:	IMPORTANCE OF THE TASK							FREQUENCY OF USE							
If the task is irrelevant to the work your employees do then circle '0' and proceed to the next task. If the task is relevant to the work that you expect from your employees then circle one number from 1 to 6 to indicate the relative importance of the task, and also circle one number from 7 to 13 to indicate how frequently the task is normally executed. If the task described is primarily used or needed as background knowledge then circle number 8.	0 NOT RELEVANT TO THE WORK WE DO	1 VERY IMPORTANT	2 IMPORTANT	3 FAIRLY IMPORTANT	4 OF MINOR IMPORTANCE	5 UNIMPORTANT	6 NOT REQUIRED AS AN ENTRY LEVEL SKILL.	7 NEVER USED	8 BACKGROUND KNOWLEDGE OR SKILL	9 ONCE PER MONTH OR LESS	10 ONCE PER MONTH TO ONCE PER WEEK	11 ONCE PER DAY TO ONCE PER WEEK	12 SEVERAL TIMES DAILY	13 HOURLY OR MORE
TASK AREAS: employee work habits.														
TASKS:														
Arriving for work at a scheduled time.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	1	1	1	1		1				1	1	1	1	
Taking responsibility for his or her own work schedule.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	2	1		1		1		1		1		2		
Working effectively with close supervision.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
		5							1			3	1	
Working effectively with little or no supervision.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
		5							1			1	1	
Working effectively alone.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
		2	2						1		1	1	1	
Working effectively with others.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
		4	1									1	2	
Recording the number of hours or parts of an hour worked in a day or on a project.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
		5										1	2	
Utilizing criticism effectively in restructuring work behavior.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
		5										1	2	
Reacting constructively to criticism that is perceived as inaccurate or unfair.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
		1	2	1	1				1		2		1	
Arriving for work dressed according to a specified dress code.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
		2	3						1		1		2	
Working evenings or weekends.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
		2	3						1		2	1	1	
Working more than 8 hours per day or 40 hours per week.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
		2	3						1			4		
Supervising the work of other employees.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
	2	1	1		1						2	1		
	0	1	2	3	4	5	6	7	8	9	10	11	12	13

V. PRELIMINARY COURSE LIST FOR AN ALTERNATIVE ENERGY OPTION TO AN ELECTRONICS PROGRAM

ENERGY PRINCIPLES AND ENERGY CONSERVATION

An introduction to basic energy fundamentals and their use in reducing energy costs in residential, agricultural, and small business applications.

Prerequisites: High School Algebra and High School Physics

EXPERIENCES IN ENERGY AUDITING AND ENERGY CONSERVATION EVALUATION.

This lab course will provide the student with practical experience in evaluating energy conservation options, using test equipment, doing energy audits, and using energy conservation devices and materials. Prerequisite: concurrent enrollment in Energy Principles and Energy Conservation.

ENERGY MANAGEMENT

Possible second level course with an emphasis on commercial, institutional and industrial energy auditing, the evaluation of energy conservation opportunities, and the preparation and implementation of energy management plans.

INTRODUCTION TO RENEWABLE ENERGY SYSTEMS

This course will introduce the student to the role of renewable energy sytems, introduce the student to system fundamentals, and survey the different system types.

Prerequisite: Energy Conservation and Energy Auditing.

RENEWABLE ENERGY SYSTEMS: DESIGN AND APPLICIATIONS

The second level course on renewable energy, with an emphasis on system design and application.

Prerequisite: Introduction to Renewable Energy Systems

SOLAR AND WIND POWER PRODUCTION

An introduction to the production of power using photovoltaics and wind generators. The course will include a survey of basic system types, methods of evaluation of electrical requirements, and the sizing of systems and storage.

ENERGY ELECTRONICS

A practical course on selecting, installing and troubleshooting control systems for solar thermal, photovoltaic, wind power and energy management sytems.

Prerequisite: Completion of a specified set of electronics courses.

MICROCOMPUTER APPLICATIONS IN ENERGY CONSERVATION AND RENEWABLE ENERGY

An introduction to and survey of commercially available computer programs to evaluate building energy performance and to aid in building and system simulation and design.

VI. COURSE LIST AND TASKS FOR AN ALTERNATIVE ENERGY OPTION TO AN ELECTRONICS PROGRAM

COURSE NAME

ENERGY PRINCIPLES AND ENERGY CONSERVATION

An introduction to basic energy fundamentals and their use in reducing energy costs in residential, agricultural, and small business applications.

Prerequisites: High School Algebra and High School Physics

TASKS TO BE INCLUDED IN THE COURSE:

Defining how heat is transferred by convection

Defining how heat is transferred by radiation

Defining four forms of energy (example: electrical, chemical, mechanical, etc.)

Explaining the Law of Conservation of Energy.

Defining the terms renewable and non-renewable energy.

Listing the proportions of energy used for different residential applications.

Drawing a time line showing the projected supply curves for natural gas, oil, & coal.

Explaining the role of energy conservation in reducing dependence on fossil fuels.

Defining 'R' value.

Defining 'U' value.

Looking up the 'R' value of a given thickness of a given material.

Calculating the total 'U' value of a given wall, ceiling, or building section.

Defining ΔT (delta T or change in temperature).

Calculating the heat loss in BTU's at a given ΔT for a given building section.

Defining the term 'Degree Days'.

Calculating the number of 'Degree Days' given a set of daily temperature records.

Calculating the heat loss for a given wall section, and local climatic data.

Defining the term 'air changes per hour'.

Calculating the heat loss due to air infiltration given weather and building data.

Calculating the heat loss in BTUH from the edge of a concrete slab floor.

Calculating the net annual heat loss in BTU's for a residential structure.

Calculating the heat gain through a south-facing window.

Calculating the heat gain through an east or west facing window.

Defining the terms 'sensible and latent heat'.

Calculating the internal sensible heat gains in a residential structure.

Calculating the latent heat gains in a residential or commercial structure.

Calculating the net seasonal cooling requirements of a residential building.

Preparing building load calculations using the ASHRAE degree-day method.

COURSE NAME:

EXPERIENCES IN ENERGY AUDITING AND ENERGY CONSERVATION EVALUATION.

This lab course will provide the student with practical experience in evaluating energy conservation options, using test equipment, doing energy audits, and using energy conservation devices and materials. Prerequisite: concurrent enrollment in Energy Principles and Energy Conservation.

TASKS:

Explaining the term peak combustion efficiency.

Explaining the term AFUE (annual fuel utilization efficiency).

Explaining the term EER (energy efficiency ratio).

Explaining the function of flue modification devices.

Recognizing common safety hazards of gas and oil furnaces.

Testing the peak combustion efficiency of a gas furnace.

Testing the peak combustion efficiency of an oil furnace.

Checking the amperage drawn by an air-conditioning unit.

Explaining the vapor compression air-conditioning cycle.

Calculating the fuel needed for heating given the efficiency and heating load.

Calculating the fuel needed for cooling given the system efficiency and cooling load.

Calculating the energy savings from switching incandescent to fluorescent lighting.

Describing the proper location for a vapor barrier in a wall and in a ceiling.

Describing the proper use of a vapor barrier in a crawl space.

Calculating the proper ventilation for attics.

Calculating the proper ventilation for crawl spaces.

Calculating the proper size for a whole house ventilating fan.

Listing and explaining at least 6 low-cost ways to reduce utility costs.

Explaining the function of a set-back thermostat.

Installing a set-back thermostat.

Describing 3 types of weatherstripping for doors or windows.

Selecting the proper types of weatherstripping for doors and windows.

Installing weatherstripping on doors.

Installing weatherstrioping on windows.

Describing the function of outlet gaskets.

Installing outlet gaskets.

Describing the function of a hot water heater insulating jacket.

Describing 5 common types of caulk and their proper use and application.

Selecting the proper type of caulk for a particular installation.

Applying caulking to doors, windows, and cracks.

Listing 5 common types of insulation and their proper uses.

Selecting the proper types of insulations for various

applications.

Performing a short walk-through residential energy audit.

Performing a thorough residential energy audit.

Preparing a formal written energy audit report.

Evaluating the cost-effectiveness of energy conservation options.

Explaining energy audit findings to a customer or client.

Explaining energy audit findings to a supervisor or co-worker.

Preparing a solar site analysis.

Explaining energy conservation options to clients or customers.

Selling energy conservation equipment or materials to customers.

Arriving for work at a scheduled time.

Taking responsibility for his or her own work schedule.

Working effectively with close supervision.

Working effectively with little or no supervision.

Working effectively alone.

Working effectively with others.

Recording the number of hours or parts of an hour worked in a day or on a project.

Utilizing criticism effectively in restructuring work behavior.

Reacting constructively to criticism that is perceived as inaccurate or unfair.

Arriving for work dressed according to a specified dress code.

Weatherization Skills Module(s):
Many of the tasks which require more sophisticated installation skills may be offered as optional modules to students with the pre-requisite skills in construction or who are concurrently enrolled in construction technology skills courses:

Installing a hot water heater jacket.

Measuring for storm windows or storm doors.

Installing plastic storm windows.

Installing glass storm windows.

Installing storm doors.

Installing fiberglass batt insulation.

Installing blown cellulose insulation.

Installing blown rock wool insulation.

Installing foam board insulation.

Installing plastic vapor barriers.

Installing wood burning stoves.

Installing mobile home underpinning.

Installing replacement windows.

Installing replacement doors.

COURSE NAME:
ENERGY MANAGEMENT

Possible second level course with an emphasis on commercial, institutional and industrial energy auditing, the evaluation of energy conservation opportunities, and the preparation and implementation of energy management plans.

Calculating the net annual heat loss in BTU's for a commercial structure.

Calculating the heat gain through an east or west facing window.

Defining the terms 'sensible and latent heat'.

Calculating the internal sensible heat gains in a commercial structure.

Calculating the latent heat gains in a or commercial structure.

Calculating the net seasonal cooling requirements of a commercial structure.

Preparing building load calculations using the ASHRAE degree day method.

Preparing building load calculations using the BIN method.

Explaining the function of flue modification devices.

Recognizing common safety hazards of gas and oil furnaces.

Testing the peak combustion efficiency of a gas furnace.

Testing the peak combustion efficiency of an oil furnace.

Checking the amperage drawn by an air-conditioning unit.

Explaining the vapor compression air- conditioning cycle.

Calculating the fuel needed for heating given the system efficiency and heating load.

Calculating the fuel needed for cooling given the system efficiency and cooling load.

Calculating the energy savings from switching incandescent to fluorescent lighting.

Explaining the cost savings that can be attained by using peak load management.

Performing a short walk-through commercial or institutional energy audit.

Performing a thorough commercial energy audit.

Performing an energy audit using a computer as part of the audit process.

Running a computer to perform heating or cooling load calculations.

Preparing a formal written energy audit report.

Evaluating the cost-effectiveness of energy conservation options.

Explaining energy audit findings to a customer or client.

Explaining energy audit findings to a supervisor or co-worker.

Explaining solar energy systems to clients or customers.

Explaining energy conservation options to clients or customers.

Explaining cost effectiveness and payback to clients or customers.

Explaining financing systems to clients or customers.

Selling solar energy systems to customers.

Selling energy management systems to customers.

Selling energy conservation equipment or materials to customers.

Handling customer sales objections.

Closing sales with customers.

Handling customer complaints.

Estimating job or materials costs and preparing bids.

Recording the number of hours or parts of an hour worked in a day or on a project.

COURSE:

INTRODUCTION TO RENEWABLE ENERGY SYSTEMS

This course will introduce the student to the role of renewable energy sytems, introduce the student to system fundamentals, and survey the different system types.

Prerequisite: Energy Conservation and Energy Auditing.

TASKS:

Explaining the role of renewable energy in reducing dependence on fossil fuels.

Explaining the role of renewable energy and energy conservation in creating jobs.

Defining beam and diffuse radiation.

Locating and using sources of solar data.

Determining the amount of solar radiation available at a given location at a given time.

Explaining the importance of the angle of incidence on the solar energy available.

Explaining the importance of solar absorptivity.

Explaining the importance of solar reflectivity.

Explaining how the different solar altitude and azimuth angles effect solar performance.

Defining the difference between active and passive solar energy systems.

Listing the advantages and disadvantages of active and passive solar energy systems.

Explaining the differences between flat plate, concentrating,

and tracking collectors.

Listing 5 major factors effecting solar collector performance.

Identifying the functions of the major parts of a solar collector

Defining solar collector efficiency.

Defining whole system efficiency.

Describing the important parts and operation of a closed loop solar DHW system.

Describing the important parts and operation of a drain back solar DHW system.

Describing the important parts and operation of a drain down solar DHW system.

Describing the important parts and operation of a thermosyphon solar DHW system.

Describing the important parts and operation of a passive or batch DHW system.

Describing the important parts and operation of a freon-type solar DHW system.

Comparing the advantages and disadvantages of the different solar DHW systems.

Describing the function of heat storage in solar collector operation.

Describing the advantages and disadvantages of air and water systems.

Defining front pass and back pass collector types.

Describing and explaining the functioning of vertical wall solar collectors.

Explaining the characteristics and the operation of direct gain solar systems.

Explaining the characteristics and the operation of Trombe Wall solar systems.

Explaining the characteristics and the operation of water wall solar systems.

Explaining the characteristics and the operation of eutectic salt storage systems.

Explaining the characteristics and the operation of solar greenhouse systems.

Explaining the importance of balancing the heat gain/loss and storage in passive systems.

Describing the functions of solar greenhouses.

Calculating the solar gain on a clear day through a south glazing.

COURSE:

RENEWABLE ENERGY SYSTEMS: DESIGN AND APPLICIATIONS

The second level course on renewable energy, with an emphasis on system design and application.

Prerequisite: Introduction to Renewable Energy Systems

Describing and explaining the functioning of vertical wall solar collectors.

Sizing domestic hot water solar heating systems.

Selecting components for domestic hot water solar heating systems.

Sizing pumps for domestic hot water solar heating systems.

Listing 4 commonly used heat transfer fluids and their proper applications.

Preparing an economic analysis for solar domestic hot water systems.

Preparing an annual cash flow analysis for domestic hot water systems.

Installing solar domestic hot water systems.

Transporting and fastening the collector(s) in place for solar DHW systems.

Connecting the pipes and fittings needed for the installation of solar DHW systems.

Installing the electronic controls, wiring and sensors for solar DHW systems.

Filling solar DHW systems with heat transfer fluid.

Testing solar DHW system for proper operation.

Designing whole house solar space heating systems.

Calculating the total amount of heat loss occurring from a swimming pool.

Calculating pool heat loss due to convection, evaporation, and nocturnal radiation.

Listing three methods to reduce heat loss from swimming pools.

Sizing swimming pool or spa solar heating systems.

Specifying components for solar pool heating systems.

Installing solar pool heating systems.

Describing the functions of solar greenhouses.

Calculating the solar gain on a clear day through a south glazing.

Calculating the solar gain on an average day through a south glazing for 1 month.

Calculating the solar gain for a heating season through a south glazing.

Calculating the solar contribution for a given building using the Los Alamos method.

Calculating the heat storage capacity of a given building material.

Determining the thermal storage requirement of a given passive solar building.

Determining the fan or blower size needed to transfer heat from a solar greenhouse.

Calculating the internal temperature of a passive solar building under given conditions.

Determining the proper overhang for a passive solar building.

Explaining solar energy systems to clients or customers.

Explaining cost effectiveness and payback to clients or customers.

Explaining financing systems to clients or customers.

Selling solar energy systems to customers.

Selling energy conservation equipment or materials to customers.

Handling customer sales objections.

Closing sales with customers.

Handling customer complaints.

Estimating job or materials costs and preparing bids.

COURSE:

SOLAR AND WIND POWER PRODUCTION

An introduction to the production of power using photovoltaics and wind generators. The course will include a survey of basic system types, methods of evaluation of electrical requirements, and the sizing of systems and storage.

Explaining how local terrain and wind tower height effect available wind speed.

Evaluating a site for available wind using an anemometer.

Describing the principal types of windmills in common use and their best applications.

Explaining the mathematical relation between increased wind speed and increased power.

Calculating daily, weekly or monthly electrical load for a client or customer.

Sizing a wind power system to fit a customer's or client's needs.

Sizing a photovoltaic electric generating system to fit a customer's or client's needs.

Sizing a battery backup system to fit a clients needs.

Sizing a back-up generator system to fit a customer's or client's needs.

Sizing and specifying DC to AC inverters to fit a customer's or client's needs.

Installing wind power systems.

Installing photovoltaic electric generating systems.

Describing the common types of photovoltaic collectors.

Explaining solar energy systems to clients or customers.

Explaining cost effectiveness and payback to clients or customers.

Explaining financing systems to clients or customers.

Selling solar energy systems to customers.

Handling customer sales objections.

Closing sales with customers.

Handling customer complaints.

Estimating job or materials costs and preparing bids.

COURSE:

ENERGY ELECTRONICS

A practical course on selecting, installing and troubleshooting control systems for solar thermal, photovoltaic, wind power and energy management sytems.

Prerequisite: Completion of a specified set of electronics courses.

TASKS:

Explaining the cost savings that can be attained by using peak load management.

Specifying and/or designing peak load management systems.

Installing differential controls for solar systems and heating controls.

Installing proportional controllers.

Troubleshooting and servicing electronic controls for solar systems in the field.

Troubleshooting and servicing electronic controls for energy management in the field.

Repairing electronic controls. (shop repairs vs unit replacement).

Interfacing solar or energy management control systems with other HVAC systems.

Specifying off the shelf electronic controls for energy management or solar applications.

Modifying off the shelf electronic controls for energy management or solar applications.

Designing custom electronic controls for energy management or solar systems.

Estimating job costs for installation, repair or design of electronic controls.

Explaining energy conservation options to clients or customers.

Explaining cost effectiveness and payback to clients or customers.

Explaining financing systems to clients or customers.

Selling electronic control systems to customers.

Selling energy management systems to customers.

Selling energy conservation equipment and controls to customers.

Handling customer sales objections.

Closing sales with customers.

Handling customer complaints.

Estimating job or materials costs and preparing bids.

COURSE:

MICROCOMPUTER APPLICATIONS IN ENERGY CONSERVATION AND RENEWABLE ENERGY

An introduction to and survey of commercially available computer programs to evaluate building energy performance and to aid in building and system simulation and design.

TASKS:

Demonstrating a minimum masterery of the operating system of one or more common microcomputers

Demonstrating the ability to operate a computer system with a reasonable level of comfort and confidence.

Demonstrating the ability to load, move and copy data files on a computer.

Demonstrating the ability to use a row and column program to perform simple energy computations.

Performing an energy audit using a computer as part of the audit process.

Running a computer to perform heating or cooling load calculations.

Running a computer program to perform active solar computations or performance predictions.

Running a computer program to perform passive solar calculations or performance predictions.

Running a computer to perform a building energy simulation program.

Running a computer to perform a photovoltaic performance analysis.

VII. EMPLOYEE SURVEY*

1. In your opinion, would more knowledge in basic electricity and electronics be beneficial to you in increasing your job skills and professional growth?

   yes 26 no 3 no opinion ____

2. Are jobs available in your present company that require a knowledge of basic electricity and electronics?

   yes 25 no 4

3. Would you seriously consider attending classes and/or workshops at Southeastern Illinois College in electronics if they were offered at a time that would not interfer with your work schedule?

	yes	no
If not paid for by your company?	11	15
If paid for by your company?	21	8

4. If your answer to the preceding question was yes, when would be the most convenient time for you to attend classes?

	day	night
Monday - Friday	10	8
Saturdays	3	
Sundays	1	

5. Have you taken trigonometry in high school or college?

   yes 11 no 18

   In the past five years? ____

   Over five years? 1

6. Would you like to take additional courses in alternative energy?

	yes	no
Energy management	15	10
Energy conservation	11	12
Solar, wind, biomass	14	18

*Surveys were sent to 100 coal miners employed at seven different coal mines within Southeastern's college district. Twenty-nine surveys were returned.

VIII. EMPLOYER SURVEY*

Using present trends and goals in your firm or business, please answer the following questions:

1. Will your firm or business need to retrain present employees in electronics technology?

   yes 7 no 1 no opinion ____

   If yes, how many?

   1 - 5 3
   5 - 10 ____
   10 - 15 2
   15 or more 2

2. Will your firm or business have a need to hire additional employees with electronics training in the next 3 to 5 years?

   yes 6 no 2 no opinion ____

   If yes, how many?

   1 - 5 4
   5 - 10 ____
   10 - 15 1
   15 or more 1

3. If your answer to either of the preceding questions was yes, to what level of competency is desirable?

   Basic electricity 6
   Basic electronics 3
   Digital electronics 4

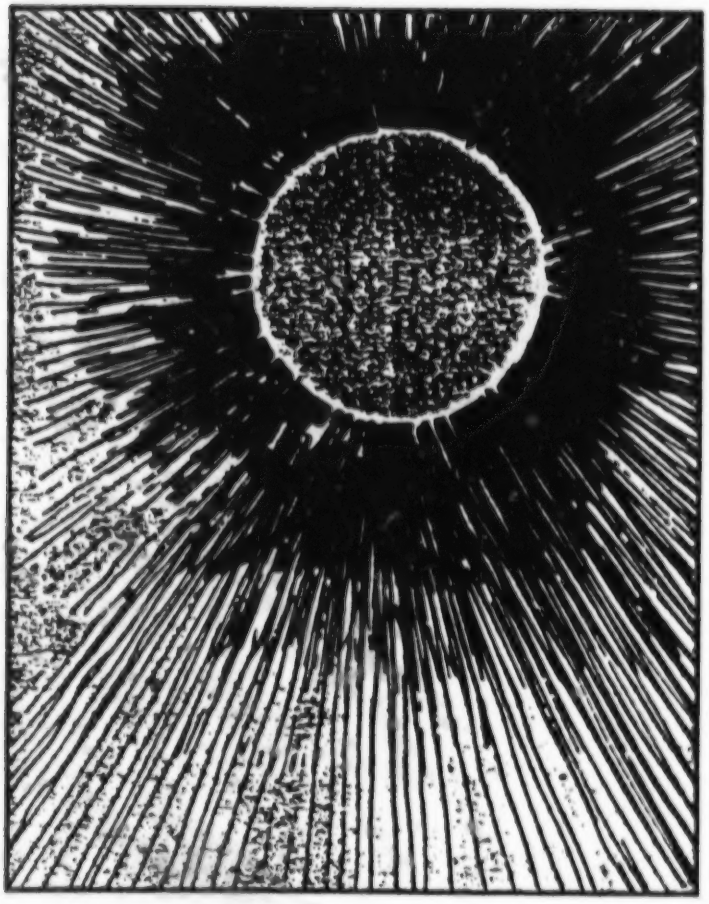
4. Would your firm or business subsidize or give release time to employees for increasing their job skills in electronics?

   yes 2 no 3 no opinion 3

5. Would your firm or business give preference to hiring employees who have some expertise in alternative energies (energy management, energy conservation, solar, wind, biomass) and electronics over employees with electronics skills only?

   yes 2 no 2 no opinion 4

*Surveys were sent to 15 employees in the fields of coal mining, construction, and industrial fabrication. All employers were located within Southeastern's college district. Eight surveys were returned.



Energy Management

Information Package

Edmonds Community College

Dear Prospective Student:

Thank you for your interest in the Energy Management program. The following information is designed to answer many of your questions.

Edmonds Community College is one of the first colleges in Washington to address the issues of energy as it relates to the economy, energy efficiency, alternative energy and total energy management. Classes range from those for the novice interested in learning more about home energy use to those advance courses for students working towards a degree and career in the energy field.

We presently offer certificates in both energy efficiency and residential auditing, and ATA degrees in Energy Management and Energy Controls. We also offer special courses, seminars and workshops on selected topics.

To enter the program, students should call the information center at 771-1545, or write to Edmonds Community College, 20000 - 68th Avenue West, Lynnwood, WA 98036, and request an appointment time for advising and registration. As program advisor, I will assist you in scheduling your class or classes. Tuition for Washington residents, those who have lived in the state for a year or longer, is presently $23.30 per credit. Out-of-state students pay $91.80 per credit. To complete the certificate program as a full-time student takes three to four quarters. The ATA degree program takes six to seven quarters.

If you have any further questions, please write or call me at 771-7406.

Sincerely,

Terry Egnor, Director
Energy Management Program

bl

Enclosures

#1699D/0142A - 5/85

Edmonds Community College

20000 68TH AVENUE WEST. LYNNWOOD. WA 98036-5999. USA.(206) 771-1500

CAREERS

Energy Management is a rapidly developing high technology field with a bright future. Increases in energy prices and regional growth have created an growing demand for qualified professionals who can effectively manage energy resources and contain costs. As in most newly emerging fields, salary, placement and career paths vary widely with the skills, education and initiative of the individual. The Energy Management program, however, has had excellent success in placing students thanks to a close working relationship with the industry. We also have an agreement with The Evergreen State College which allows our graduates to transfer the full two year Edmonds' ATA towards a four year degree.

PROGRAM

The Energy Management program is designed to prepare students for management and technical roles in energy supply, consumption and conservation. The curriculum is constantly being revised to keep pace with this fast moving field. The College offers programs in four major areas:

ENERGY MANAGEMENT - The major focus of this two year degree program is the reporting and auditing of energy consumption, development of operating plans and conservation guidelines, supervision of control systems, and the assessment of benefits realized from sound energy management practices. The program requirements are listed under "Associate of Technical Arts Degree-Energy Management".

ENERGY CONTROLS - The controls ATA is closely related to that of energy management, but there is a much greater emphasis on the design, installation and operation of control systems. The expanding commercial control and building automation industry needs technicians with cross training in energy systems as well as electronic and computer technology. The course includes approximately a year of electronics as a base. Additional work in computers and energy complete the package. The program requirements are listed under "Associate of Technical Arts Degree-Energy Controls".

ENERGY EFFICIENT TECHNOLOGY - Study in this area prepares students for work in the residential energy field, either in construction or auditing. Two Certificates are offered, each requiring approximately three quarters to complete.

Construction topics include insulation and weatherization strategies as well as equipment utilization for maximum cost/benefit. The program requirements are listed below under "Certificate-Residential Energy Efficiency".

Students interested in working as energy auditors for utilities take additional courses in analysis and computer programming. The program requirements are listed below under "Certificate-Residential Conservation Specialist".

RENEWABLE ENERGY TECHNOLOGY - This specialty area deals with various renewable energy sources and their practical applications. Sources studied include solar, wind, bio-mass and small scale hydro. Topics include design criteria, installation, maintenance and operation, economics and cost/benefit analysis. Students interested in this field take either the Residential Energy Certificate or the Energy Management ATA. There is no specific degree offered in renewables.

FACULTY AND FACILITIES

The Energy Management faculty is committed to quality instruction and state-of-the-art information. In addition to the full time instructors, the Department includes a number of experts currently working in the energy field who have demonstrated knowledge and skills and who have a personal commitment to teaching. Special guest lecturers are common throughout the program.

To augment the classroom, the Department makes extensive use of laboratory and on-site experience. The electronics and computer labs are an integral part of the instructional process. The solar energy test facility on the roof of Mountlake Terrace Hall provides both hands-on training and research opportunities. Frequent field trips and internships allow the student to gain significant experience with real world systems.

During this next year, the Department will be moving to the new Applied Technology Center being built opposite the Fluke and Boeing complexes at Paine Field as part of the I-405 High Technology Corridor. There, the program will have the additional support of our own building energy management system and the synegistic effects of working with other high technology programs, such as electronics, avionics, telecommunications and CAD/CAM.

ADMISSIONS REQUIREMENTS

Although full time students must begin in September if they wish to complete the course in the minimum amount of time, enrollment is possible during any quarter. Individual courses may be taken by students wishing to supplement their skills without going for a degree or certificate on a space available basis. Students enrolling in the two year degree programs should have intermediate algebra and college level composition skills no later than the end of the first quarter. A background in the physical sciences is also useful for all of the programs. For more specific information on prerequisites, requirements and course of study, contact the program advisor.

All programs require a minimum of 24 resident credits and a 2.00 cumulative grade point average for graduation. A Degree or Certificate Application should be submitted one quarter before completing study.

PROGRAM REQUIREMENTS

ASSOCIATE OF TECHNICAL ARTS
ENERGY MANAGEMENT
(99 CREDITS REQUIRED)

GENERAL REQUIREMENTS (19 credits)
****
CMPSC 115 Intro to Computer Prgm
ENGL 105 College Composition
CONST 142 Arch Blueprint II
PHYS 140 Conceptual Physics

MANAGEMENT REQUIREMENTS
****
MGMT 100 Human Relations
MGMT 114 Principles of Mgmt
MGMT 130 Principles of Mrktng

PROGRAM REQUIREMENTS
****
ENRGY 100 Intro Energy Policy
ENRGY 111 Commrcl Energy Effic
ENRGY 150 Fund Heat Transfer
ENRGY 160 Energy Electronics
ENRGY 200 Energy Pln & Oper
ENRGY 201 Energy Mgmt Analysis
ENRGY 211 Comm Auditing and Calc
ENRGY 220 Energy Control Devices
ENRGY 250 Computer Bldg Simult
ENRGY 260 Comm Bldg Syst Mgmt
ELECTIVES 15 Credits (pre-appvd)

ASSOCIATE OF TECHNICAL ARTS
ENERGY CONTROLS
(105 CREDITS REQUIRED)

GENERAL REQUIREMENTS (19 credits)
****
CMPSC 115 Intro to Computer Prgm
ENGL 105 College Composition

ELECTRONICS REQUIREMENTS (50 credits)
****
ELTRN 124/5/6 Elec,Pneu,Hydlcs
ELTRN 151 DC Circuits
ELTRN 152 AC Circuits
ELTRN 153 Semiconductor Circuits
ELTRN 154 DC Circuit Analysis
ELTRN 155 AC Circuit Analysis
ELTRN 156 Digital Schematics

PROGRAM REQUIREMENTS
****
ENRGY 100 Intro Energy Policy
ENRGY 150 Fund Heat Transfer
ENRGY 200 Energy Pln & Oper
ENRGY 201 Energy Mgmt Analysis
ENRGY 211 Comm Auditing and Calc
ENRGY 220 Energy Control Devices
ENRGY 222 Advanced Control Devices
ENRGY 250 Computer Bldg Simult
ENRGY 260 Comm Bldg Syst Mgmt

CERTIFICATE
RESIDENTIAL ENERGY EFFICIENCY
(49 CREDITS REQUIRED)

GENERAL REQUIREMENTS (17 credits)
****
CONST 141 Blueprint I
CONST 170 Intro to Mech Systems
CONST 220 Suprntndnt Orient OR
CONST 250 Safety/Accdt Prevnt
ENGL 111 Tech Report Writing

PROGRAM REQUIREMENTS (32 credits)
****
ENRGY 100 Intro Energy Policy
ENRGY 101 Basic Energy Prncpls
ENRGY 110 Energy Effcnt Design
ENRGY 130 Solar Energy Cncpts
ENRGY 150 Fund Heat Transfer
ENRGY 160 Energy Electronics
ENRGY 230 Advanced Solar Cncpts

CERTIFICATE
RESIDENTIAL CONSERVATION SPECIALIST
(49 CREDITS REQUIRED)

GENERAL REQUIREMENTS (22 credits)
****
CONST 141 Blueprint I
CONST 170 Intro to Mech Systems
ACCT 110 Acct for Non-acctnts
CMPSC 115 Intro to Computer Prgm
ENGL 111 Tech Report Writing

PROGRAM REQUIREMENTS (27 credits)
****
ENRGY 100 Intro Energy Policy
ENRGY 101 Basic Energy Prncpls
ENRGY 110 Energy Effcnt Design
ENRGY 130 Solar Energy Cncpts
ENRGY 140 Renewable Energy Systms
ENRGY 150 Fund Heat Transfer

EDMONDS COMMUNITY COLLEGE

ENERGY MANAGEMENT PROGRAM

TECHNICAL COURSE DESCRIPTIONS

ENRGY 100 - INTRODUCTION TO ENERGY (5 credits)

This course will cover the history of energy use, energy sources, the development of the energy "crisis," and energy policy at the local, national and international levels. Particular attention will be given to the role of conservation and renewable energy sources in our energy future in the Pacific Northwest. Prerequisite: Concurrent enrollment in ENRGY 101.

ENRGY 101 - BASIC ENERGY PRINCIPLES (3 credits)

Introduction to the sources and nature of energy, terminology, measurement and applications. Includes an overview of calculation procedures for applying thermodynamic principles to real systems. Prerequisite: concurrent enrollment in ENRGY 100.

ENRGY 110 ENERGY EFFICIENT DESIGN (4 credits - 3 Lec, 2 Lab)

How to design and build an effective energy envelope including: design strategies and innovations for new construction, devices and alternatives for energy use in existing buildings, materials used in conservation and how to use them properly, such as: insulation types, windows, control devices, vapor barriers and thermal storage. Prerequisite: ENRGY 101, or instructor's permission.

ENRGY 111 - COMMERCIAL ENERGY EFFICIENCY (5 credits)

This course will provide students with a basic understanding of energy using systems in commercial buildings and the latest materials, designs and technology available for making them efficient. Topics include envelope, lighting, motor boiler and HVAC measures.

ENRGY 130 - SOLAR ENERGY CONCEPTS (4 credits - 3 Lec, 2 Lab)

This course will acquaint the student with the basic technology of solar heating, the application of solar energy in the home and business, and provide background for wise decision making effecting his energy future. Physical concepts of light and heat will be presented as related to collection, storage and utilization of solar energy. Prerequisite: ENRGY 101 or instructor's permission.

ENRGY 140 - RENEWABLE ENERGY SYSTEMS (4 credits - 3 Lec, 2 Lab)

A survey of appropriate technology using small scale systems which can be built and used by individuals or small groups. Basic information and data needed for construction in the Pacific Northwest will be presented. Topics include: wind, hydro, biomass and integrated systems. Conservation and solar will NOT be included in this course (See ENRGY 110 and 130).
Prerequisite: ENRGY 101 or by instructor's permission.

ENRGY 150 - FUNDAMENTALS OF HEAT TRANSFER/HVAC (5 credits)

Introduction to the sources and nature of energy, terminology, principles measurement, and applications in energy system design and operation. Topics include: heat and temperature, transfer, heat recovery and cogeneration, heat engines and power generation, refrigeration and heat pumps.

ENRGY 155 - ENERGY UPDATING SEMINARS (1-5 credits)

Updating energy seminars would contain information on current issues or problems facing energy consumption, conservation and/or renewable energies and to supplement exisiting energy courses. Possible topics might include: new types of energy control devices, energy "fairs," consumer awareness of energy conservation measures, workshops on installation techniques, etc.

ENRGY 160 - ENERGY ELECTRONICS (4 credits - 3 lec, 2 lab)

A survey course for energy management students in certificate or ATA degree programs. Basic AC/DC and solid state theory as well as practical applications in building systems and energy technology will be covered. Prerequisite: ENRGY 101 and PHYS 140 or instructor's permission.

ENRGY 200 - ENERGY PLANNING AND OPERATIONS (5 credits)

This course will provide students with a framework for energy planning and operations within an organization. Topics include: system integration, analysis and documentation, proposal development, reporting and record-keeping stategies, monitoring and evaluation techniques.

ENRGY 201 - ENERGY MANAGEMENT ANALYSIS (5 credits)

This course will examine the methodologies available for evaluating the economic parameters of energy projects. Topics include: partial methods of evaluation, comprehensive methods, special factors influencing energy investment and alternative financing options.

ENRGY 210 - RES. AUDITING/CALCULATIONS (5 credits)

Energy use in residential and light commercial buildings, their shell, mechanical, electrical and human systems will be studies. Students will learn intensive and extensive analysis of building heat losses and gains, economic analysis of conservation alternatives including life cycle costing through laboratory sessions consisting of energy audits of local buildings. The role of proper maintenance in reducing energy use will be covered. prerequisite: High school algebra or MATH 60, ENRGY 150, or instructor/ coordinator permission.

ENRGY 211 - COMMERCIAL AUDITING/CALCULATIONS (5 credits)

This course will focus primarily on the methodology of commercial auditing and the calculations involved in analyzing commercial buildings. Topics covered will include: Mechanical and electrical systems and their normal operation, thermal balancing, building envelope, and monitoring and measurement of conditions. Case studies of actual buildings will be used and students are expected to complete an energy audit of a major facility as part of the program.

ENRGY 220 - ENERGY CONTROL DEVICES (3 credits)

Energy Control Devices will provide an in-depth study of the function and use of devices that regulate energy use in buildings. Both manual and automatic control of simple switches through programmable microprocessors will be studied with emphasis on conserving energy. Core material including control logic plus several guest speakers from the controls industry provide an interesting and informative format. Prerequisite: ENRGY 160 and 211 or equivalent experience with permission of coordinator/instructor.

ENRGY 222 - ADVANCED CONTROL DEVICES (5 credits)

The emphasis in this course will be on the actual installation and inter-connection of controls and the equipment being controlled. Topics will include: Hardwire, multiplex, PC and telephone systems, commercial wiring techniques and codes, actuators and sensors, and M & O consideration. PREREQUISITE: ENRGY 220 or equivalent.

ENRGY 230 - ADVANCED SOLAR ENERGY CONCEPTS (5 credits)

This course will include detailed analysis of solar heating and cooling systems in residential and industrial applications, and the integration of solar with other heating systems. Photo-electric conversion will also be studied. Other topics will include: equipment survey, installation techniques and control systems. Prerequisite: ENRGY 130 and 160 or by instructor's permision.

ENRGY 250 - COMPUTER BUILDING SIMULATIONS (5 credits)

This course will cover the variety of computer programs available for analyzing residential and commercial buildings. Topics include code and output format, residential standards, BIN methodology, hourly simulations and an overview of current programs on the market. PREREQUISITE: CMPSC 115/116 or instructor's permission.

ENRGY 260 - COMMERCIAL BUILDING SYSTEMS MANAGEMENT (4 credits - 3 lec, 2 lab)

Integrated management of mechanical, electrical and plumbing systems to maximize efficiency. Topics will include: system balancing, co-generation, utility rates, structures and programs, waste heat recovery and recycling programs. Prerequisite: ENRGY 160, 211 and 220 or by instructor's permission.

ENRGY 292 - ENERGY COOPERATIVE WORK EXPERIENCE SEMINAR (1 credit)

For students enrolled in Energy Cooperative Education. A career-related course designed to assist students in developing their job objectives, exploration of career options, and the development of work attitudes. Prerequisite: Instructor/coordinator permission. Concurrent enrollment in ENRGY 293.

ENRGY 293 - ENERGY COOPERATIVE EDUCATION (Maximum 3 quarters - 10 credits)

Students are employed in a career-related work assignment in the community, coordinated by the college and the employer, to provide on-the-job training as a learning experience. Prerequisite: Instructor/coordinator permission. Concurrent enrollment in ENRGY 292.

ENRGY 299 - SPECIAL PROJECTS/INDEPENDENT STUDY (1-5 credits)

College credit for individual projects in energy, especially involving energy management in buildings or in engineered processes, solar, or other renewable energy systems. Example projects might include an installed solar water heating system, an energy conservation and management plan devised and carried out at one's home or place of business, building an energy conserving device (e.g., electric car). The range of projects is vast, but the project must effect real changes that result in energy savings.
Prerequisite: Faculty sponsor and approval of division representative.

Energy Management

TENTATIVE COURSE OFFERINGS

1985-86

COURSE NUMBER & TITLE	INSTRUCTOR	CREDITS	DAYS	TIME
Fall Quarter 1985				
100 Intro Energy Policy	Egnor, T.	5	M & W	6:00 - 8:00 pm
150 Fund Heat Transfer	Egnor, T.	5	M & W	8:00 -10:00 pm
200 Energy Pln & Oper	Egnor, T.	5	T & Th	8:00 -10:20 pm
211 Comm. Auditing and Calc	Scace, J.	5	T & Th	6:00 - 8:00 pm
299 Special Projects	Egnor, T.	ARR	ARR	ARR
Winter Quarter 1986				
160 Energy Electronics	Egnor, T.	5	T & Th	6:00 - 8:00 pm
201 Energy Mgmt Analysis	Egnor, T.	5	T & Th	8:00 -10:20 pm
220 Energy Control Devices	Becker, O.	5	M & W	6:00 - 8:00 pm
250 Computer Bldg Simult	Weis, L.	5	M & W	8:00 -10:20 pm
299 Special Projects	Egnor, T.	ARR	ARR	ARR
Spring Quarter 1986				
222 Advanced Control Devices	Becker, O.	5	M & W	5:45 - 8:00 pm
260 Comm Bldg Syst Mgmt	Becker, O.	5	M & W	8:00 -10:20 pm
111 Commrcl Energy Effic	Egnor, T.	5	T & Th	8:00 -10:20 pm
140 Renewable Energy Syst	Egnor, T.	5	T & Th	5:45 - 8:00 pm
(124, 5, 6 ELTRN Elec, Pheu, Hydl		5Total	ARR	ARR)
299 Special Projects	Egnor, T.	ARR	ARR	ARR

REGISTRATION BY APPOINTMENT

For currently enrolled matriculated students	June 17, 18
For new and former matriculated students	June 19, 20 or July 15,
For currently enrolled non-matriculated students	July 17, 18
For new and former non-matriculated students	July 22, 23
OPEN REGISTRATION for all students without appointments	July 24 - July 31

For appointment please call 771-1544.

Edmonds Community College